Essays in Public and Labor Economics

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Abstract

This dissertation comprises three chapters. The first chapter estimates the crowd-out effect of Social Security on private retirement saving. In a quasi-experimental research design, I analyze the effect of the 1990 federal mandate of Social Security coverage for all state and local government employees who were not covered by an equivalent state pension. Using a sample of more than 12 million employer-employee observations on earnings and contributions to retirement plans, I find that Social Security coverage induces approximately 16% of those affected who had previously saved in private retirement plans to stop contributing. For those who continue contributing, Social Security coverage crowds out about 23% of pre-reform contributions.

The second chapter, joint with Jeffrey B. Liebman, explores labor market experiences of American men over the last decades. Using data from the Survey of Income and Program Participation (SIPP), matched with Social Security Administration earnings and benefit records, we follow individuals born in the 1940s-1970s by cohort and education groups. We show substantial heterogeneity across education groups; high school dropouts start holding their first job later, have more years without significant earnings, a higher number of cumulative jobs, higher job exit rates, and lower average tenure than, for example, high school graduates.

Across cohorts our results illustrate that all education groups achieve significant earnings later in more recent cohorts. Particularly among the least-educated, the percentage who has not achieved significant earnings by their late 20s is increasingly rapidly across cohorts.

The third chapter investigates to what extent OASDI disability and Supplemental Security Income recipients have become healthier over time in the cross-section. Using administrative benefit data, matched with self-reported health status from the Survey of Income and Program Participation, I show that particularly when measuring health by limitations in Instrumental Activities of Daily Living (IADLs), male benefit recipients report fewer IADLs over time throughout the period observed from 1984 to 2004.

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Introduction

This dissertation comprises three chapters. All three essays use large data sets with administrative earnings and benefit receipt data from the Social Security Administration. The first chapter estimates the crowd-out effect of Social Security on private retirement saving. In a quasi-experimental research design, I analyze the effect of the 1990 federal mandate of Social Security coverage for all state and local government employees who were not covered by an equivalent state pension. Using a sample of more than 12 million employer-employee earnings observations, I identify individuals affected by this reform, and compare their savings behavior before and after the reform to a control group covered by state pension plans. A novelty of this essay is the use of an administrative measure of the flow into tax-deferred retirement saving plans. Preliminary results indicate that Social Security coverage induces approximately 16% of those affected who had previously saved in private retirement plans to stop contributing. For those who continue contributing, Social Security coverage crowds out approximately 23% of pre-reform contributions.

The second chapter, joint with Jeffrey B. Liebman, explores labor market experiences of American men over the last decades. Using data from the Survey of Income and Program Participation (SIPP), matched with Social Security Administration earnings and benefit records, we follow individuals born in the 1940s-1970s by cohort and education groups. We compare our results to the seminal paper by Topel and Ward (1992), who used administrative data to provide an overview of male labor market experiences for a cohort born between 1939 to 1948.

We show that Topel and Ward's results (1992) mask substantial heterogeneity across education groups; high school dropouts start holding their first job later, have more years without significant earnings, a higher number of cumulative jobs, higher job exit rates, and lower average tenure than, for example, high school graduates. Across cohorts our results illustrate that all education groups achieve significant earnings later in more recent cohorts. Particularly among the least-educated, the percentage who has not achieved significant earnings by their late 20s is increasingly rapidly across cohorts. We show that the majority of this group receives disability benefits by age 28. Across the most recent cohorts analyzed, we observe that average tenure decreased and the average number of jobs held increased over time, particularly for high school dropouts. Among the least-educated we find substantial heterogeneity; While some high school dropouts progressively lose real earnings when they stay in the same job, change jobs frequently, and remain at low tenure levels throughout their lifetime, others manage to establish stable careers with high tenure, low exit hazards, and positive real earnings growth starting in their late 20s.

The third chapter investigates to what extent OASDI disability and Supplemental Security Income recipients have become healthier over time in the cross-section. We use administrative data on disability applications, diagnoses, and benefit receipt, matched with health data based on self-reported health status, as well as limitations in Basic and Instrumental Activities of Daily Living (BADLs and IADLs) from the Survey of Income and Program Participation. We show that particularly when we measure health by limitations in Instrumental Activities of Daily Living (IADLs), male benefit recipients report fewer IADLs over time throughout the period observed from 1984 to 2004. The better average health status of recipients is driven by two forces: First,

individuals with mental disorder diagnoses make up a larger fraction of the total population on disability benefits over time. Given that those recipients are relatively healthier across all measures than individuals with other diagnoses, this drives the average health status to improve. Second, recipients with musculoskeletal disorders, an increasing diagnosis group, are reporting to be relatively healthier, particularly as measured by IADLs, in cross sections over time.

Chapter 1

How does Social Security Affect Saving? Evidence from Eligibility Changes for State and Local Government Employees.[1]

[1] This project has been funded by the Social Security Administration through the Dissertation Fellowship Program in Retirement Research administered by the Center for Retirement Research at Boston College.

1.1 Introduction

The optimal design of Social Security weighs the trade-off between protection and distortion. Public pensions protect the aged from poverty, and insure against a decline in living standards as individuals retire. The system of Social Security, however, introduces several distortions: The government needs to levy taxes to finance pensions, which distorts labor supply of the working population. Moreover, individuals have a strong incentive to retire by the age when they are allowed full benefits, which distorts the timing of retirement. Importantly, the expectation of public retirement benefits will distort individuals' private retirement saving behavior. The subject of the present paper is to estimate this last distortion. To understand this crowd-out of private retirement saving by Social Security is of primary policy importance given that most developed economies are considering pension reforms to counteract the lack of fiscal sustainability of traditional pay-as-you-go systems. As full retirement age is increased, and pension benefits reduced in many countries, it is important to know to what extent individuals will make up for such changes by adjusting their private retirement savings.

Empirically, the question of the degree of substitutability of Social Security wealth and private retirement saving has not been settled satisfactorily. One of the difficulties associated to estimating the effect of Social Security is that it is a national program, covering nearly the entirety of the U.S. population, and any related policy changes affect all individuals equally. This makes it hard to find a control group to compare any effect to. This paper addresses that gap by analyzing how a specific group of individuals that had previously not been covered by Social Security changed their private retirement saving behavior as they became eligible for Social

Security benefits. The eligibility reform studied took place following a federal reform in 1990 that mandated Social Security coverage for all state and local employees who had not been covered previously.

Before the reform, individuals uncovered by Social Security would contribute a fraction of their gross income into tax-deferred private retirement plans, realize a return based on how the savings were invested until retirement, and then consume he amassed saving during the retirement period. After the reform, newly covered individuals are now mandated to "contribute" a fraction of their gross income (12.4% including both the employee and employer contributions) to the public retirement plan, Social Security, in the form of Social Security taxes. They realize a return on those contributions that depends replacement rates and full retirement age, driven by population growth rates. Once again they consume the amassed Social Security benefit entitlements upon retirement. In a simple life-cycle model, we would expect coverage by actuarially fair Social Security to induce individuals to reduce private savings one-for-one with the discounted value of expected Social Security benefits. However, there are several reasons why Social Security wealth might not be a perfect substitute for private retirement saving. First, Social Security might provide higher benefits than the optimally planned consumption in retirement by some individuals. This would lead workers newly covered by Social Security to reduce their retirement savings to zero, but this reduction would represent less than the discounted value of future benefits. Second, if expected benefits for an individual are less than the sum of taxes paid, she might choose to increase private savings in an effort to re-optimize. Third, institutional aspects of the Social Security system such as the retirement age might induce individuals to retire earlier than they otherwise would have, thus

needing more savings for a longer retirement period (Feldstein and Liebman, 2002). Fourth, Social Security wealth is not liquid, and cannot be borrowed against, which may induce individuals to reduce private retirement saving by less than the full amount of an increase in Social Security wealth if they are liquidity constrained. Fifth, the implied rate of return of Social Security wealth is lower than that of private financial wealth. Last, there are differences in the tax treatment of Social Security and private retirement saving, especially when private saving is conducted in a tax-deferred instrument. Both imply a less-than-perfect crowd-out of private retirement saving in response to an increase in Social Security wealth.

To estimate the impact of Social Security on private saving empirically has been challenging. First, scholars have examined the time-series relationship between saving and expected Social Security benefits, and consistently found that Social Security crowds out overall private savings significantly[2]. Feldstein (1996), for example, finds that an additional dollar of "Social Security wealth" (i.e. present actuarial value of future Social Security benefits) leads to only 2.8 cents of additional consumption in retirement, implying a large crowd-out effect. However, Lesnoy and Leimer (1985) argue that individuals may have difficulty in correctly calculating their Social Security wealth, and may thus optimize based on other parameters, leading to potentially different results. In general, time-series estimations of the effect of Social Security face the challenge that many other policies apart from the generosity of Social Security changed over the time period studied. It is thus difficult to identify only the effect of Social Security on savings behavior. Second, scholars have analyzed the effect of Social Security on private savings in cross-sectional studies, relying on variation in Social Security wealth across individuals in

[2] See, for example, Feldstein (1974, 1996), Lesnoy and Leimer (1985), Pfau (2005).

microeconomic datasets. Feldstein and Pellechio (1979) showed that for an additional dollar in Social Security wealth, private savings are reduced by approximately 70 cents. Kings and Dicks-Mireaux (1982) focused their study on a single Canadian cross section and the relationship between individuals' Social Security wealth and their stock of saving, both relative to permanent income. Samwick (1997) calculated in a similar methodology for the U.S. a crowd-out of effect of Social Security wealth of approximately 20% of the stock of saving. The difficulty with cross-sectional studies is that the variation in Social Security wealth across individuals is correlated with other factors that affect private savings, which often cannot be controlled for. The results might thus be subject to omitted variable bias. The most convincing attempt to estimate the relationship between Social Security wealth and private saving is offered by Attanasio and Brugiavini (2003) who analyze the effect of a pension reform in Italy, which offered exogenous variation in public pension wealth. While the identification strategy of comparing savings behavior before and after a pension reform is promising, the authors still use repeated cross-sections of a household survey dataset. This leaves their analysis open to the omitted variable bias criticism mentioned above. Even though the authors control for a variety of variables that influence saving behavior, there are many unobserved factors that would affect an individual's saving. Moreover, Attanasio and Brugiavini's (2003) measure of private saving is based on self-reported survey responses. This measure is prone to measurement bias: individuals may not report, intentionally misreport, or overestimate their private saving. Even this well-identified study therefore struggles to convincingly answer the question how much public pensions crowd out private saving. Third, another literature identifies the effect of Social Security on private savings based on cross-national variation (e.g. Modigliani and Sterling,

1983). Given that a myriad of other factors affect private savings behaviors in different countries, and it is difficult to argue that differences would be solely due to Social Security benefit variations. The existing literature thus does not satisfactorily answer to what degree, if any, Social Security coverage crowds out private savings.

This paper aims to address this shortcoming through a quasi-experimental research design, using an exogenous change in Social Security eligibility for a relatively large group of state and local government employees. In contrast to the existing literature, I use an administrative measure of private retirement savings, derived from panel data on flows into tax-deferred pension plans. This reduces measurement error in private saving estimates significantly relative to previous studies based on survey data, and thus prone to non-response, recall, and misreporting biases.

While state and local government employees were originally excluded from Social Security, coverage of those employees by Social Security or an equivalent state pension plan was federally mandated in 1990[3], and resulted in an estimated additional 3.7 million public employees joining the Social Security system in 1991.[4] Most states had state pension plans before they opted into Social Security, but often excluded significant numbers of their employees, in particular part-time and temporary employees, and specific occupations depending on the individual plan. My study focuses on those state and local government employees (SLEs) who were excluded from pre-existing state pension plans, and then became eligible for Social Security in 1991 when coverage became mandatory. In a difference-in-difference estimation, I compare flows into private retirement saving vehicles before and after

[3] Omnibus Budget Reconciliation Act of 1990, P.L. 101-508 (104 Stat. 143)
[4] Source: Social Security Administration via Freedom of Information Act Request S9H: AE4116.

the eligibility reform of those affected to those with similar characteristics who had already been covered by Social Security prior to 1990. I find that Social Security coverage induces approximately 16% of affected individuals who were previously contributing to private retirement plans to stop contributing, and crowds out approximately 23% of the pre-reform contributions of those who continue contributing.

The research design from this paper differs from the majority of the existing literature for several reasons. First, my estimates of the effect of Social Security on private saving are plausibly causal, given the identification strategy of studying saving changes following unanticipated and mandatory coverage of individuals without any previous pension plan. Second, in contrast to Feldstein (1974, 1996), I use individual-level rather than aggregate data on private saving and Social Security wealth. Third, in contrast to King and Dicks-Mireaux (1982) and others I use the flow of saving as an outcome variable, rather than the stock. My estimates are therefore much less affected by asset price volatility. Last, in contrast to Attanasio and Brugiavini (2003), I use administrative data both on private retirement saving flows, and on earnings histories, which determine Social Security wealth, rather than survey data.

The remainder of the paper is organized as follows: Section 1.2 discusses the Social Security eligibility reform of 1990 in detail. Section 1.3 describes the data and in particular our measure of private retirement savings. Section 1.4 discusses our empirical methodology and presents results on the effect of Social Security wealth on private retirement saving. Section 1.5 concludes.

1.2 Mandatory Coverage of State and Local Government Employees

State and local government employees (SLEs) were originally excluded from Social Security coverage due to constitutional concerns about state employers having to pay their share of an employee's Social Security contributions to a federal entity. Moreover, many SLEs were already covered under state pension plans when Social Security was introduced in 1935. Coverage by state pension plans continued to expand, but was not universal among SLEs. Starting in the 1950s, public employers were allowed, but not mandated, to elect Social Security coverage for their employees through terminable Section-218 Agreements. Those employees that already had state pension plan coverage tended to choose "Medicare-only" coverage. Employers could choose certain groups of the employees that would be excluded from Section-218 Agreements. Starting in 1983, such agreements could not be terminated anymore. Many state and local government employers did not choose full Social Security coverage prior to 1990. Anecdotal evidence suggests that unions played a significant role in avoiding Social Security coverage out of fear of losing state pension coverage[5].

As part of the 1990 budget[6], Social Security coverage was mandated for all state and local government employees unless they were already covered by an equivalent state pension system. The law became effective on July 1st, 1991. After this date, state and local employees previously not covered were required to pay Social Security taxes, and were in return eligible for Social Security benefits upon retirement. The mandate was plausibly unanticipated, as mandatory Social Security coverage of SLEs had been proposed in the previous three budget

[5] Conversation with Deputy State Social Security Administrator for Colorado, October 2010.
[6] The Omnibus Budget Reconciliation Act was approved on November 5th, 1990.

processes by the Administration, but never passed until 1990. The renewed proposal of mandatory coverage could have been anticipated, but not the fact that it ultimately passed into legislation. In fact, the measure was first rejected as part of the budget summit agreement of September 30th, 1990, and only resurfaced shortly before the budget was passed on November 5th, 1990. The proponents' arguments were mainly centered around the estimated additional $20 billion in net Government revenues over five years from Social Security contributions, rather than simply the merits of covering a group of SLEs without pension coverage. This short-term focus ignored the longer-term fiscal impact of being responsible for paying benefits to the newly covered group.

Table 1.1: SSA Estimates of State and Local Government Employees Not Covered by Social Security or by a Retirement Plan, 1991

Numbers of Employees in '000s

	All State and Local Government Employees			Part-Time State and Local Government Employees			
	Total #	Uncovered by OASDI or State Pension		Total #	%	Uncovered by OASDI or State Pension	
State	of Employees	# Employees	%	of PT Employees	PT Employees	# Employees	%
Massachusetts	506	203	40.1%	127	25.2%	118	92.5%
Connecticut	291	114	39.2%	88	30.1%	66	75.1%
Ohio	805	267	33.2%	152	18.8%	145	95.5%
Michigan	640	200	31.3%	231	36.1%	104	44.8%
Maine	116	36	31.0%	25	21.9%	16	63.7%
Tennessee	371	109	29.4%	47	12.8%	15	31.3%
Illinois	938	265	28.3%	238	25.3%	155	65.3%
Hawaii	92	25	27.2%	16	17.5%	13	83.3%
California	2,222	576	25.9%	364	16.4%	306	84.0%
Minnesota	414	105	25.4%	80	19.2%	47	59.4%
New York	1,892	471	24.9%	443	23.4%	284	64.2%
Wisconsin	424	104	24.5%	137	32.2%	61	44.7%
Colorado	278	60	21.6%	35	12.6%	22	62.9%
South Carolina	336	67	19.9%	97	28.9%	41	41.8%
Oklahoma	275	54	19.6%	75	27.4%	35	46.1%
Nevada	75	14	18.7%	9	12.5%	7	74.4%
Rhode Island	70	12	17.1%	11	15.4%	6	56.5%
Kentucky	282	48	17.0%	51	18.1%	25	48.6%
Iowa	273	44	16.1%	67	24.5%	20	29.7%
Indiana	440	70	15.9%	104	23.7%	46	43.8%
South Dakota	79	12	15.2%	25	31.1%	6	25.9%
Texas	1,331	198	14.9%	194	14.6%	98	50.8%
North Carolina	612	87	14.2%	135	22.1%	49	36.1%
North Dakota	73	10	13.7%	18	24.1%	3	18.7%
Nebraska	163	22	13.5%	48	29.4%	13	27.8%
Idaho	101	13	12.9%	28	27.7%	6	21.5%
Kansas	276	35	12.7%	70	25.4%	22	30.9%
Montana	81	10	12.3%	19	23.0%	4	24.2%
Florida	864	106	12.3%	56	6.5%	40	71.5%
West Virginia	151	18	11.9%	24	16.2%	8	32.4%
Louisiana	321	38	11.8%	35	10.9%	17	47.3%
Delaware	60	7	11.7%	19	32.4%	3	16.2%
Wyoming	62	7	11.3%	17	28.1%	5	26.4%
Alaska	64	7	10.9%	14	21.8%	6	40.4%
Alabama	328	33	10.1%	61	18.5%	17	28.2%
Virginia	556	53	9.5%	84	15.1%	13	15.7%
New Hampshire	107	10	9.3%	31	28.7%	6	18.8%
Arizona	334	31	9.3%	53	15.8%	10	18.7%
Vermont	65	6	9.2%	24	36.4%	3	11.4%
Georgia	535	44	8.2%	62	11.5%	5	7.9%
Missouri	384	30	7.8%	68	17.6%	13	19.8%
Oregon	279	18	6.5%	73	26.2%	12	16.2%
Utah	157	9	5.7%	34	21.4%	4	11.0%
Maryland	355	16	4.5%	65	18.3%	11	17.6%
Arkansas	194	8	4.1%	31	15.8%	2	7.1%
Mississippi	221	9	4.1%	37	16.8%	6	16.4%
New Mexico	153	6	3.9%	16	10.6%	3	21.2%
Washington	441	14	3.2%	70	15.9%	9	12.5%
Pennsylvania	730	20	2.7%	195	26.7%	15	7.5%
New Jersey	669	13	1.9%	135	20.2%	2	1.8%
Total of all States	20,486	3,734	18.2%	4,137	20.2%	1,943	47.0%

While all states offered state pension plans to public employees in 1990, they differed vastly in the percentage of employees that were eligible to participate. Table 1.1 illustrates SSA's

estimates that approximately 3.7 million, or 18% of all state and local government employees in the U.S. were not covered by any retirement plan in 1991 before the legislation went into effect. In some states, a third or more of public employees were not covered by a retirement plan (Massachusetts, Connecticut, Ohio), while in other states less than 5% of public employees were affected by the legislative change (Maryland, Arkansas, Mississippi, New Mexico, Washington, Pennsylvania, New Jersey). The right-hand side of Table 1.1 shows that in some states (Massachusetts and Ohio), more than 90% of part-time or temporary SLEs were neither covered by Social Security nor a state retirement plan before the implementation of the reform. On the other side of the spectrum, in states such as Georgia, Arkansas, Pennsylvania, and New Jersey less than 10% of part-time or temporary SLEs were uncovered by both Social Security and state retirement plans at the beginning of 1991.

In order to be eligible for Social Security benefits upon retirement, newly covered individuals were required to fulfill the general condition of having worked for at least 40 quarters in covered employment, equal to at least 10 years of work[7]. For those who started paying Social Security taxes in 1991, this meant that they had to work until and including the year 2000 in order to be eligible for benefits.

[7] An individual earns a covered quarter by earning more than a specified amount, which changes with the national average wage index. Independently of total earnings, a person can only earn a maximum of four covered quarters each year. (http://www.ssa.gov/oact/cola/QC.html#qcseries).

1.3 Data

I use a 1 percent representative sample of the Social Security Administration's Master Earnings File (MEF) records for the period from 1978 to 2009, consisting of 12.1 million employee-employer observations. The MEF includes individual annual data by employer on IRS taxable earnings, Medicare taxable earnings, Social Security taxable earnings, self-employment income, and contributions to deferred compensation plans, as well as state identifiers, date of birth, sex, and race[8]. The data also allows me to distinguish state and local government employers, which make up 14% of the sample in 1990. I matched the MEF file to the Summary Earnings Records file, where total covered annual earnings are available starting in 1951. I can thus determine exactly when a newly-covered SLE started paying Social Security contributions, as well as the full employment history of the individual with the employer for which earnings became covered. I use the entire earnings history to estimate both when individuals become eligible for Social Security benefits. The data does not, however, offer information on whether an individual was covered by a state retirement plan. Given that state pension plans tend to be more generous than Social Security, we assume that only those without state pension coverage switched to Social Security in 1991.

Table 1.2 shows SLEs identified in my sample by state who were uncovered by Social Security prior to the reform, as well as how many of those began paying Social Security taxes in 1991. In total, 40,942 SLEs had only uncovered earnings in 1990, of which 12%, or 5,080 became newly covered by Social Security in 1991 (i.e. started paying Social Security taxes on earnings, and did not switch employer). This implies that 88% of those identified as uncovered were able to avoid

[8] The race variable in SSA administrative data is not considered reliable.

Table 1.2: Number of Uncovered, and Newly Social-Security-Covered State and Local Employees, by State

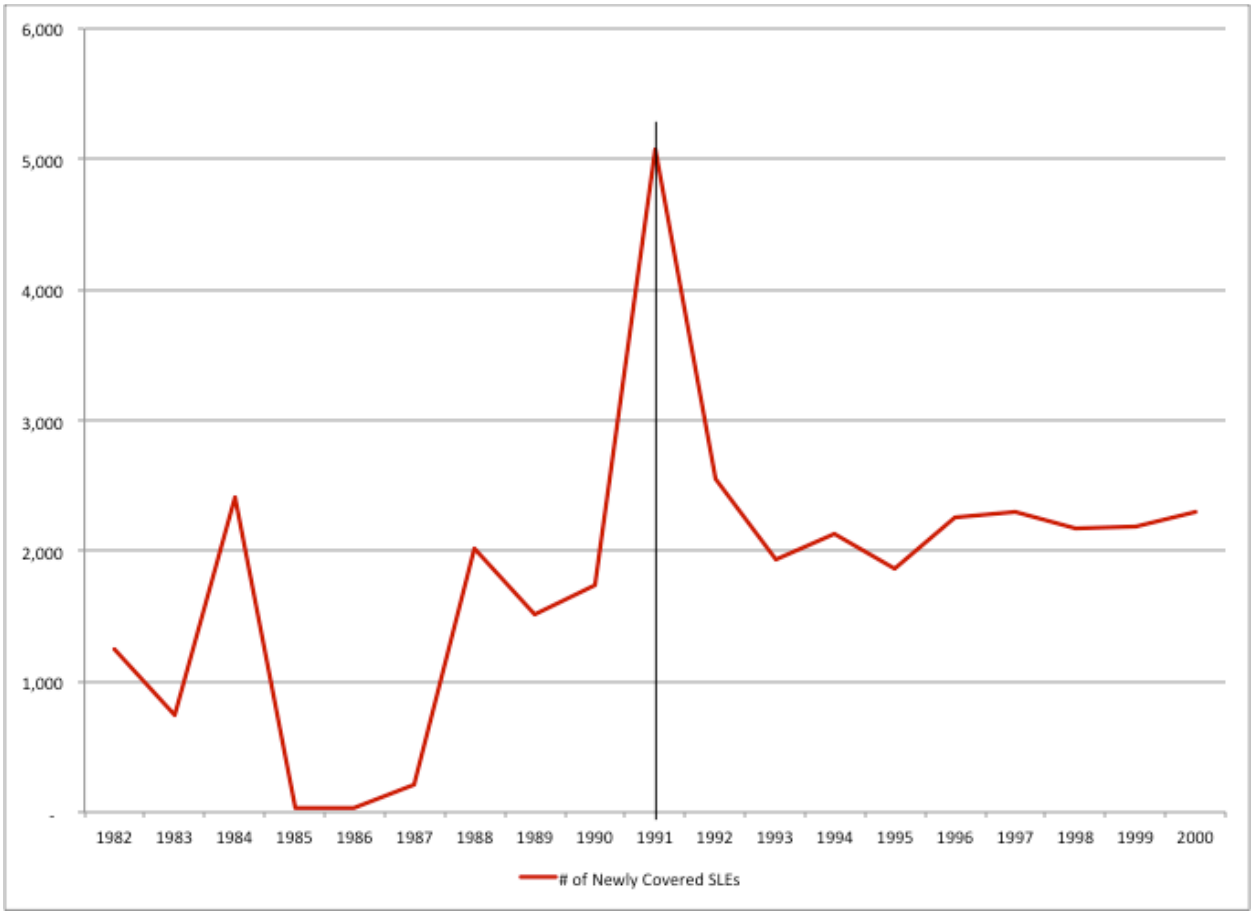
1% Sample of Total Population (Master Earnings File)

State	# Uncovered SLEs in 1990	# SLEs Newly Covered by Social Security	
		1991	% of Uncovered SLEs
New York	2,617	969	37%
Minnesota	1,114	303	27%
Delaware	175	44	25%
Hawaii	52	12	23%
Florida	1,436	326	23%
Wisconsin	746	159	21%
Rhode Island	139	29	21%
Connecticut	407	80	20%
Tennessee	710	128	18%
Nevada	288	45	16%
California	6,605	894	14%
North Dakota	120	16	13%
Iowa	440	57	13%
Kentucky	416	52	13%
Michigan	1,529	188	12%
Georgia	1,019	124	12%
Washington	693	83	12%
Idaho	78	9	12%
New Jersey	406	45	11%
Illinois	1,664	184	11%
Montana	140	15	11%
Arizona	286	30	10%
Indiana	498	52	10%
Vermont	39	4	10%
New Hampshire	59	6	10%
Massachusetts	1,311	129	10%
Kansas	279	26	9%
Mississippi	184	17	9%
Pennsylvania	632	56	9%
Lousiana	1,266	112	9%
South Dakota	92	8	9%
Texas	3,346	283	8%
Oregon	422	35	8%
New Mexico	273	22	8%
Utah	292	23	8%
District of Columbia	904	70	8%
Virginia	588	43	7%
Arkansas	277	20	7%
Maine	252	18	7%
Missouri	565	38	7%
North Carolina	524	35	7%
Wyoming	78	5	6%
Oklahoma	452	28	6%
West Virginia	194	11	6%
Nebraska	249	13	5%
Maryland	531	27	5%
South Carolina	322	16	5%
Colorado	1,088	49	5%
Alabama	434	17	4%
Ohio	3,039	103	3%
	40,942	**5,080**	**12%**

being covered by an equivalent state pension plan. This table illustrates an inconsistency with Table 1.1, the official SSA estimates on the number of SLEs likely affected by the Social Security mandate. While SSA estimated that 3.7 million SLEs were uncovered by both Social Security and a state retirement plan before the reform, which would have implied around 37,000 newly covered individuals in a representative 1% sample, we identify only 5,080 individuals who actually started contributing newly to Social Security in 1991. Extrapolated to the full population, our estimate would indicate a total population of affected SLEs around 500,000. This inconsistency might be rooted in a combination of several different causes: 1) an initial overestimate by the SSA on the amount of affected individuals, 2) state pension plans potentially reacting to the legislative change by allowing more individuals to join, 3) uncovered individuals moving jobs before mandatory coverage could take effect, and 4) not all affected employees are covered immediately in 1991, but there is a phased response. The states with the highest estimated percentage of uncovered workers who became newly covered in Table 1.2 correspond to a large degree with the states in Table 1.1 for which SSA had estimated the largest impact of the reform.

Figure 1.1 shows the number of newly covered SLEs identified in the 1% MEF sample by year. We clearly see the impact of mandatory coverage in the form of a spike in 1991. However, in the years thereafter, approximately 2,000 SLEs continue to be identified every year as newly covered by Social Security. There are several possible explanations for this: 1) Some SLEs might have been covered by state pension plans, and thus did not join Social Security in 1991, but chose to do so later on, given widespread financial woes of state retirement systems.

Figure 1.1: Number of Newly Covered State and Local Government Employees by Year in 1% MEF Sample



2) The Social Security Independence and Program Improvements Act of 1994 allowed states the option to extend Social Security and Medicare coverage to police officers and firefighters covered by state pension plans (previously, only 23 states were specifically authorized to do so). This might have phased in individuals in this category gradually. 3) There are some exceptions to the mandate of Social Security coverage for SLEs who are not covered by an equivalent pension plan: election workers and students do not have to be covered. If those individuals

continued into a different job position with the same public employer, they will appear as having been newly covered by Social Security in the data[9].

At the employee-employer level, between 8-9% of earnings observations remain not covered by Social Security after 1991, mostly representing state and local government employees with state pension plans, who were not required to participate in Social Security.

Measuring Private Retirement Savings

The existing literature has measured savings either at the aggregated country level, or through a variety of self-reported survey measures. Some used direct estimates on assets, and others imputed savings as the difference between income and consumption. All of those measures suffer from classical survey data issues, including non-response and recall biases, as well as misreporting. This paper is novel in its use of administrative savings data. When estimating the effect of Social Security on private savings, we would ideally like to have data on household net worth, including all types of financial and real assets. In the absence of such an administrative measure, we focus only on private retirement savings, in the form of contributions to tax-deferred pension plans. While we clearly do not capture all private savings, contributions to such retirement plans are plausibly a major form of private savings towards retirement, and the closest substitute to Social Security wealth among private assets.

[9] http://www.ssa.gov/section218training/basic_course_4.htm, accessed on 10/1/2013.

The variable for contributions to deferred compensation is populated in the MEF starting in 1990. This variable records amounts listed on the 1990 W-2 in Box 17 as deferred compensation contributions to 401(k) (employer-sponsored retirement plan), 403(b) (retirement plan for certain employees of public schools, employees of certain tax-exempt organizations, and certain ministers), 408(k)(6) (simplified employee pension with a salary reduction agreement), 457(b) (retirement plan for governmental and certain non-governmental (non-profit organizations) organization), or 501(c)(18)(D) (retirement plans for labor unions) plans[10]. Given that the population of interest is SLEs, most relevant contributions captured in the deferred compensation variable are toward 457(b) plans.

457(b) plans are similar in design to 401(k) plans[11], in the sense that contributions, as well as earnings on those contributions, are tax-deferred for IRS purposes until distribution. In both cases they are, however, subject to Social Security and Medicare taxes at the time of contribution. Deferred compensation is thus exactly the difference between Medicare taxable income and IRS taxable income. This fact allows us to impute values for the deferred compensation variable, despite the fact that the variable is populated only starting in 1990 in the MEF, given that we observe Medicare taxable and IRS taxable earnings already at the introduction of tax-deferred retirement plans in 1984. However, we can only conduct this imputation for SLEs who are covered by Medicare. Beginning in 1986, all newly hired SLEs are

[10] On the 2012 W-2, deferred compensation is recorded in Box 12 under codes D, E, F, G, or H.

[11] The main difference between 457(b) and 401(k) plans is that with the former, there is no 10% penalty for withdrawal before age 59 ½. http://www.irs.gov/Retirement-Plans/IRC-457(b)-Deferred-Compensation-Plans, accessed on 10/1/2013.

mandatorily Medicare-covered[12]. SLEs hired prior to that date could be covered either by both Social Security and Medicare, or by Medicare only through Section 218 agreements. We exclude those SLEs who were not covered by Medicare, as we cannot impute deferred compensation for the years prior to the Social Security eligibility reform for them[13].

Table 1.3 shows the correlations between the imputed and reported measures of annual deferred compensation. In year 1990, the first year for which reported deferred compensation is available in the MEF, the correlation is relatively low at 13% for our sample. I hypothesize that this is due to initial reporting issues, as the first year of data is believed to be unreliable by staff at the SSA. Thereafter, correlations remain fairly high between 67% and 85% throughout the 1990s.

Table 1.3: Correlation Between Imputed and Reported Deferred Compensation Amounts

Year	Correlation
1990	13%
1991	76%
1992	83%
1993	83%
1994	74%
1995	73%
1996	83%
1997	84%
1998	85%
1999	67%

Imputed deferred compensation amounts are on average consistently larger than their reported equivalents. Table 1.4 illustrates the average absolute differences between imputed

[12] http://www.ssa.gov/slge/mand_med_cov.htm, accessed on 10/1/2013.

[13] By excluding SLEs who are not covered by Medicare prior, we exclude 22% of all SLEs in 1990.

and reported amounts. Median error is zero in all years. The average error represents between 28% and 55% of average reported deferred compensation levels during the years 1990-1999, decreasing over time.

Table 1.4: Magnitude of Imputation Error for Deferred Compensation

In 1990 USD

Year	Median |Imputed DC - Reported DC|	Average |Imputed DC - Reported DC|	% of Average DC
1990	0	812	55%
1991	0	816	43%
1992	0	716	38%
1993	0	746	38%
1994	0	839	39%
1995	0	835	37%
1996	0	724	31%
1997	0	720	29%
1998	0	742	28%
1999	0	794	28%

1.4 Empirical Results

1.4.1 Effect of Social Security on Private Pension Contributions: Difference-in-Difference Design

I estimate the effect of being newly covered by Social Security on private retirement savings. Given that our quasi-experiment takes place at a time when tax-deferred retirement saving vehicles were still being rolled out, it is important to take into account overall increases in the extensive and intensive margin of contributions during the time of the Social Security eligibility reform we are analyzing. Therefore, I first conduct a difference-in-difference analysis.

The treatment group is comprised of those SLEs who were newly covered by Social Security in 1991. Those individuals had positive IRS-taxable earnings, but no Social-Security-taxable from an SLE employer in 1990, and positive IRS-taxable and positive Social-Security-taxable earnings from the same employer in 1991. The control group is made up of SLEs who had positive IRS-taxable, but no Social-Security-taxable earnings from the same SLE employer in both 1990 and 1991. This condition implies that the control group had already been covered by an equivalent state pension plan pre-reform, and therefore did not need to be covered by Social Security in 1991.

Table 1.5 presents summary statistics for several key variables. Out of 160,483 individuals who worked for SLEs identified in the 1% MEF sample between 1986 and 1990, 5,080 (3.2%) are in the "treatment group". This group worked for a state or local government employer before the reform, with positive IRS earnings, but no Social Security earnings, while after the reform, their records indicate both positive IRS and Social Security earnings. This is a direct effect of previously non-covered individuals becoming covered by Social Security following the reform. 16,432 individuals (10.2% of all SLEs) are in the "control group", and post positive IRS earnings, but no Social Security earnings from the same state and local government employer both before and after the reform. Legally, earnings can only remain uncovered if the individual was covered by an equivalent state pension plan. Table 1.5 illustrates that relative to all SLEs, both treatment and control groups are significantly younger (33.8 and 31.7 years on average, relative to 38.1 for all SLEs), and have lower average earnings (15,754 and 20,005, relative to 29,671 for all SLEs). Both treatment and control groups are also more likely to hold a second job apart

from their SLE job (61% of all SLEs hold only the SLE job, compared to 46% and 47% for treatment and control groups, respectively).

Table 5: Summary Statistics, 1% MEF Sample

2012 USD

	All SLEs in 1990	Treatment: SLEs SS-Uncovered in 1990, SS-Covered in 1991	Control 1 "State Pension": SLEs SS-Uncovered in 1990, SS-Uncovered in 1991
# Observations	160,483	5,080	16,432
Sex and Age			
% Female	57.8%	62.3%	58.3%
Average Age	38.1	33.8	31.7
Std. Dev. of Age	*13.5*	*14.5*	*12.6*
Race			
% White	78.0%	74.1%	76.2%
% Black	14.1%	15.1%	12.2%
% Hispanic	1.0%	2.1%	1.8%
Earnings			
Mean IRS Earnings, 1990	29,671	15,754	20,005
Std. Dev. of IRS Earnings, 1990	*23,884*	*19,241*	*20,610*
Retirement Saving			
% Contributing to Private Retirement Plans, 1990	39.6%	7.6%	30.8%
Mean Contribution to Private Retirement Plans, 1990	2,871	2,560	2,646
Std. Dev. of Retirement Contribution, 1990	*3,310*	*3,384*	*2,521*
Mean Saving Rate, 1990	6.3%	5.9%	7.2%
Std. Dev. of Saving Rate, 1990	*0.054*	*0.063*	*0.044*
Number of Jobs			
Median # of Jobs, 1990	1.0	2.0	2.0
% One SLE Job, No Other Job	60.9%	46.1%	47.1%
% One SLE Job, Other Non-SLE Jobs	31.5%	39.4%	40.6%
% More than One SLE Job, No Other Jobs	4.2%	7.3%	6.5%
% More than One SLE Job, Other Non-SLE Jobs	2.8%	6.7%	5.6%
Percentage of Earnings from SLE Job			
Mean % Earnings from SLE Job, 1990	82.1%	73.7%	74.3%
Std. Dev. Of % of Earnings from SLE, 1990	*0.322*	*0.361*	*0.357*
Self-Employment Income			
% with Positive Self-Employment Income, 1990	4.2%	5.3%	3.8%
Mean Self-Employment Income, 1990	9,685	10,388	10,620
Std. Dev. of Self-Employment Income, 1990	*15,296*	*16,406*	*17,719*

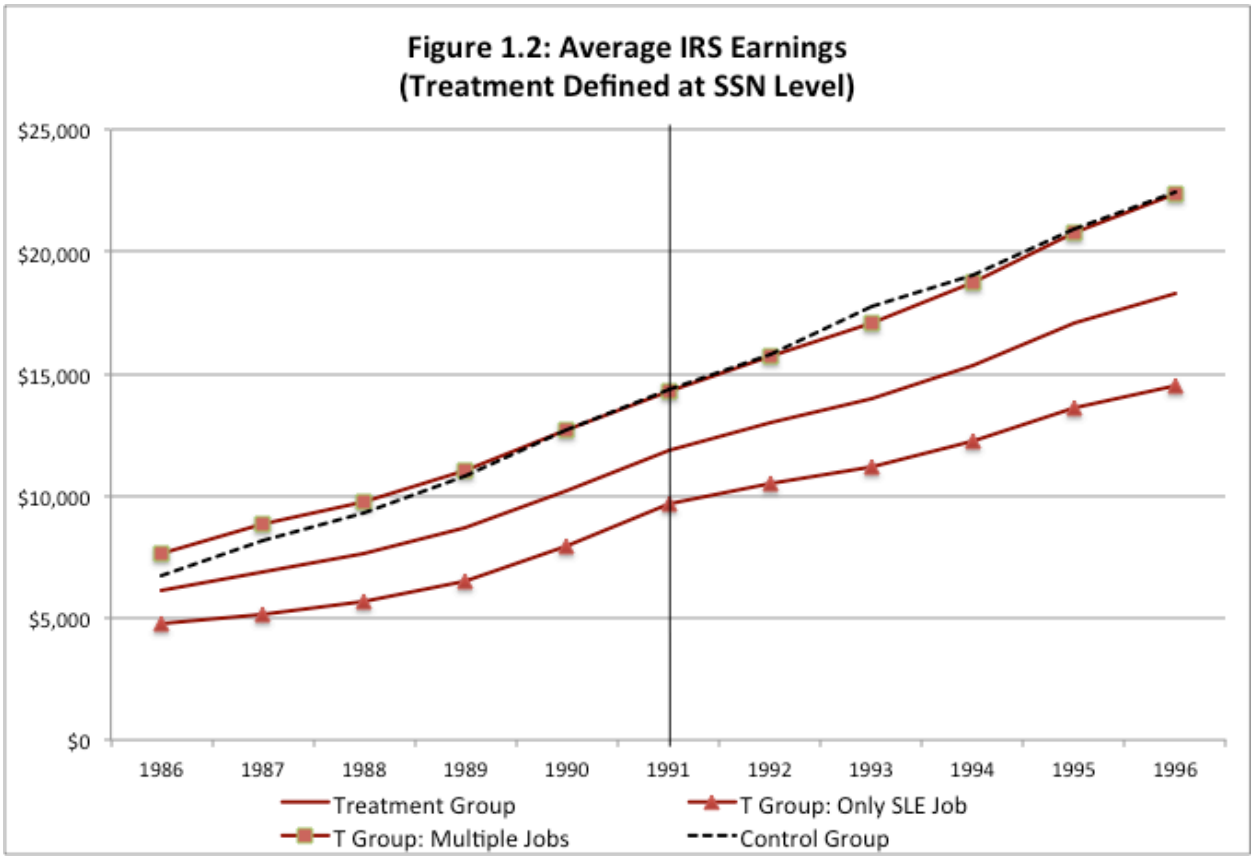
When comparing treatment against control group, the data on earnings shows that there are some significant differences between the treatment and control groups: the treated individuals earn on average more than 20% less than the control group. This is likely due to the fact that state and local government employers offer state pension plans (implying membership in the

control group) to more seasoned employees, while part-time and temporary employees with lower salaries are more likely not to have a state pension plan, and therefore be in the treatment group. Table 1.5 also shows that there is a large difference in participation in private retirement plans between the treatment and control groups before the reform: while 30.8% of the control group contributed to a private retirement plan in 1990, only 7.6% of the treatment group did so. Moreover, the treatment group is has a slightly higher proportion of females (62.3 vs 58.3%), is slightly older (33.8 vs 31.7), more diverse (74.1 vs 76.2% share of white individuals), and more likely to have self-employment income (5.3 vs 3.8%).

Given that a relatively large fraction of the treatment group holds additional jobs apart from the SLE job for which they became newly covered by Social Security in 1991, I divided the group into "high" and "low" intensity of treatment. "High intensity" treated individuals only hold one job, which is the one for which they became newly Social Security covered. "Low intensity" treated individuals instead may hold other jobs in addition, which might have given them some Social Security coverage already prior to the reform. The following graphs illustrate data for the entire treatment group, as well as the high and low intensity subgroups.

In comparing contributions to private retirement saving plans before and after the reform between those individuals who were newly covered by Social Security and those who had been on state pension plans, I rely on the identification assumption of parallel trends in key variables for both groups. Figures 1.2 and 1.3 illustrate that both for IRS and for Medicare earnings, pre-reform trends are indeed relatively parallel between treatment and control groups. The earnings level of the control group is most comparable to the treatment group with multiple

jobs. Average Medicare earnings in Figure 1.3 are higher than IRS earnings in Figure 1.2, with the difference representing deferred compensation, i.e. contributions to private retirement saving plans.



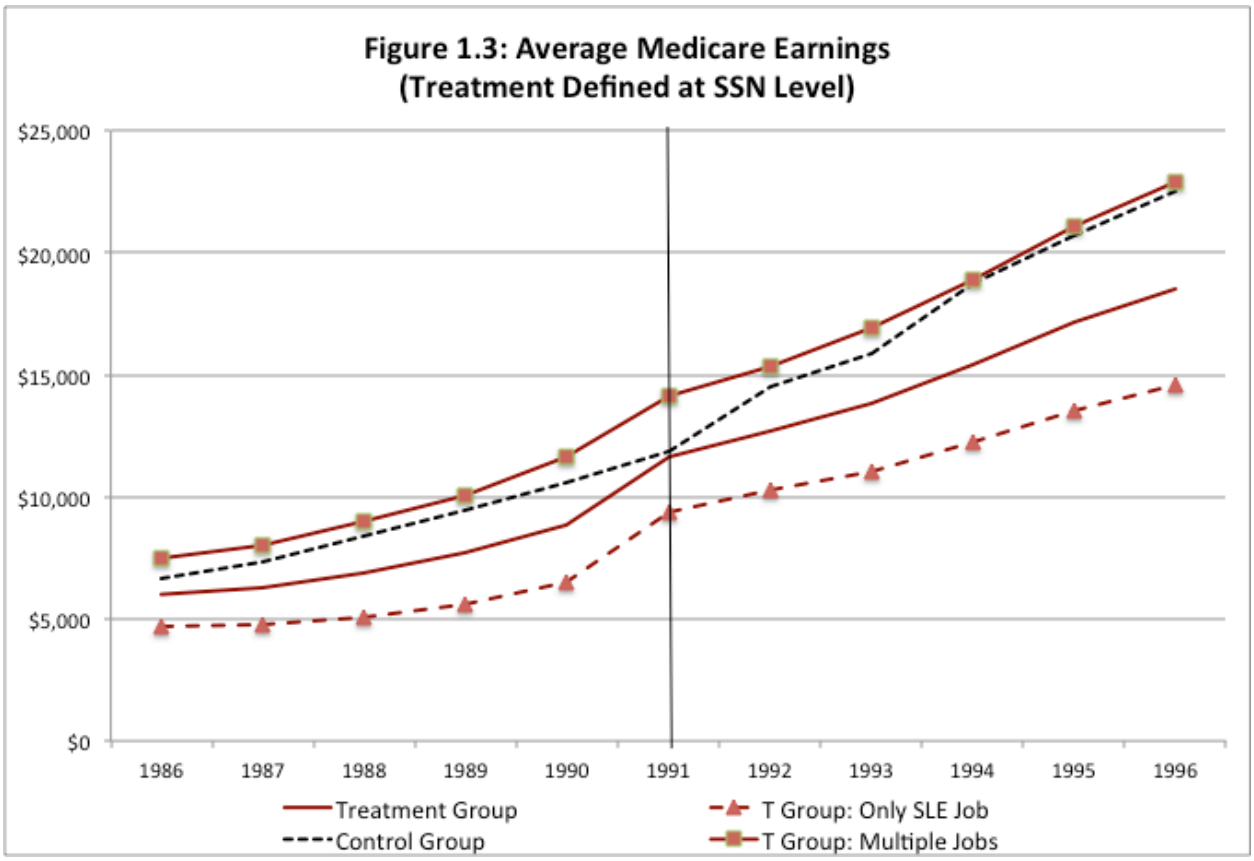
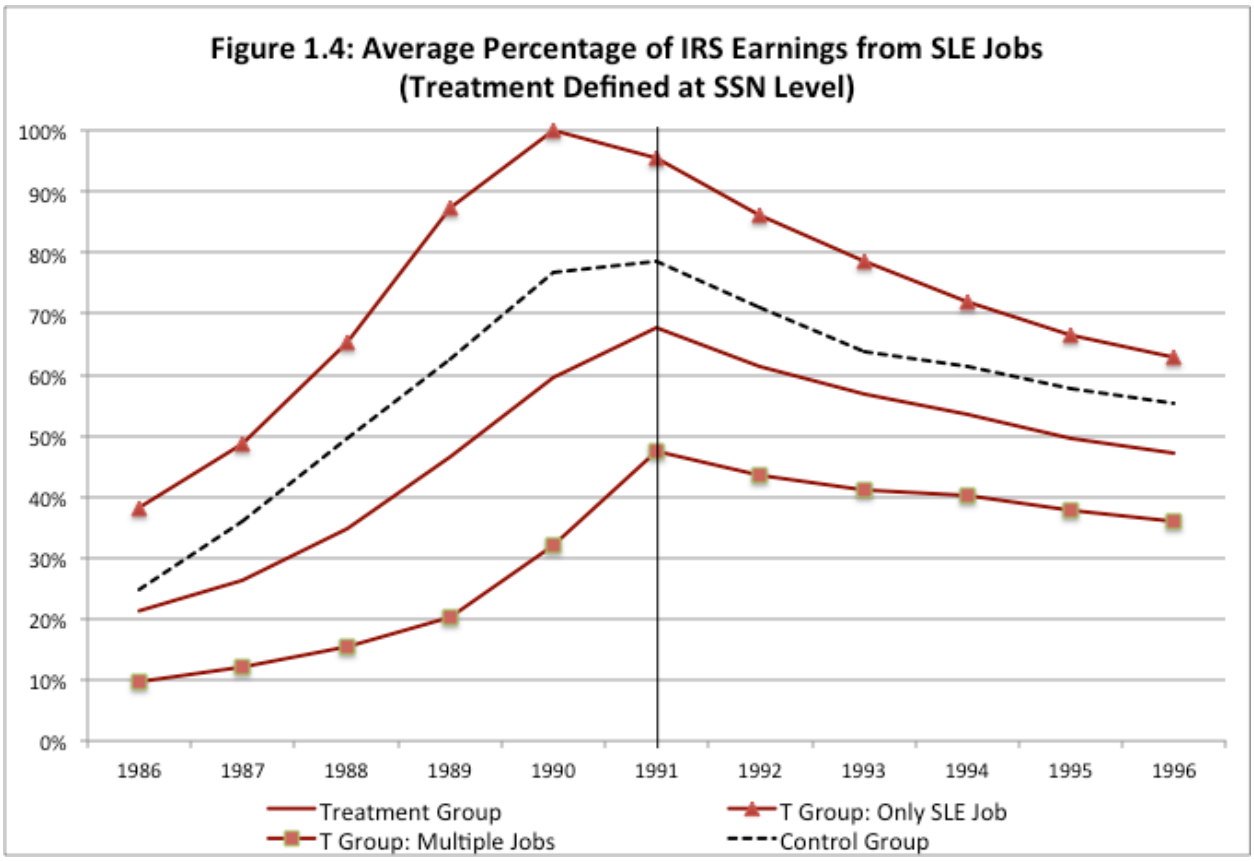


Figure 1.4 illustrates the average percentage of IRS earnings from SLE jobs. The average treatment group individual gained 60% of his earnings from the SLE job in the pre-reform year 1990. By construction, the treatment subgroup with only one SLE job earned 100% from the SLE job, compared to 32% for the treatment subgroup with multiple jobs. The control group received 77% of earnings from the SLE job. The percentage of earnings from the SLE job evolves similarly for both treatment and control groups before and after the reform.

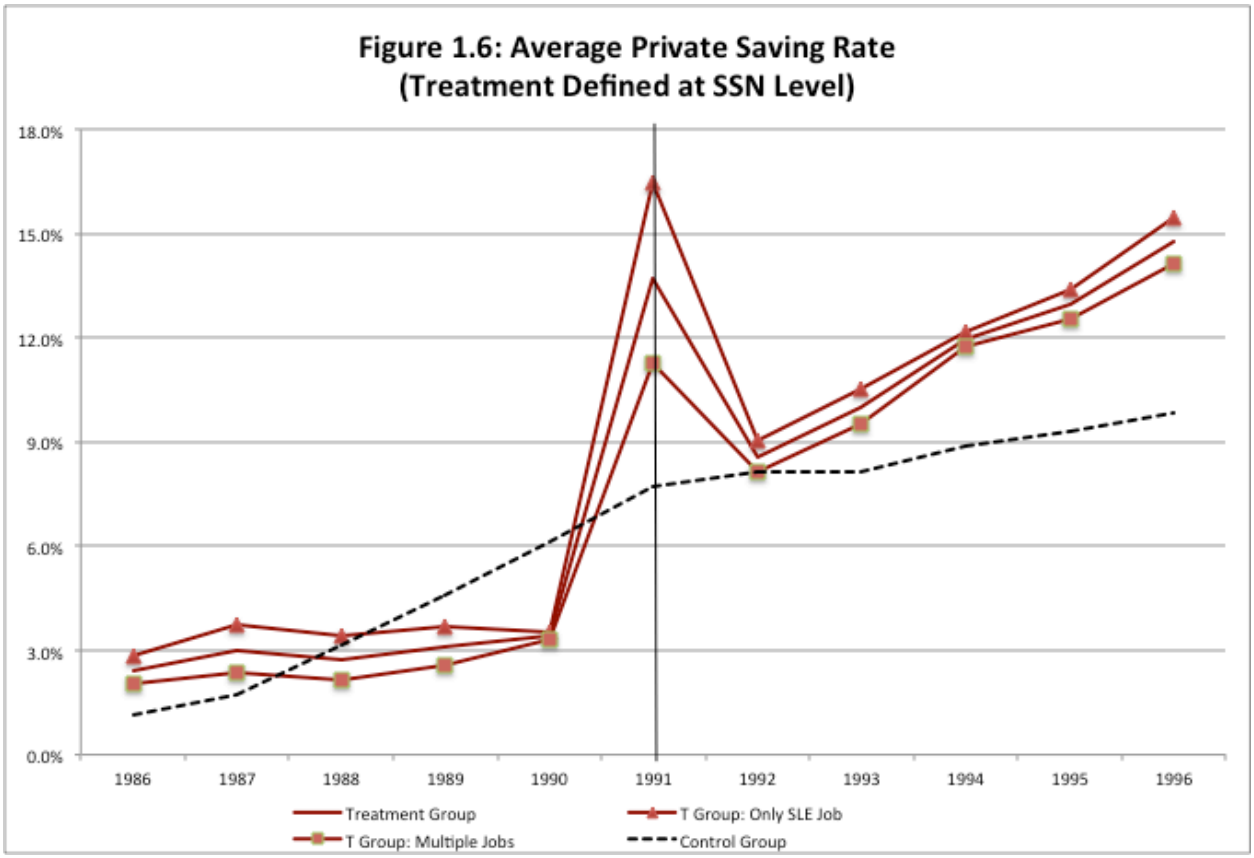


Having established that on the earnings dimension, pre-reform trends are relatively similar for treatment and control groups, we will now analyze the outcome variable of interest: contributions to private retirement saving vehicles. Figure 1.5 illustrates the average imputed contribution to private retirement plans before and after the reform, excluding those individuals who did not make any contributions. We observe a relatively flat trend before the reform, and a spike in the year 1991, following by a large drop for the treatment group. Given that Social Security coverage for those newly covered took effect on July1st, those individuals had an incentive to contribute before the July 1st date. Those early contributions would not be subject to Social Security taxes, while later contributions would be. I thus hypothesize that the spike in 1991 for the treatment group is a result of this tax incentive, and the true long-run

effect of Social Security coverage on private saving is captured by the subsequent drop in 1992. After this level change, contribution trends continue to be parallel for treatment and control groups, though the treatment groups' contributions are approximately $600 less on average, consistent with a crowd-out effect of Social Security coverage. Compared to an average pre-reform contribution level of $2,560, this suggests that Social Security coverage crowds out approximately 23% of previously uncovered individuals' private retirement savings.

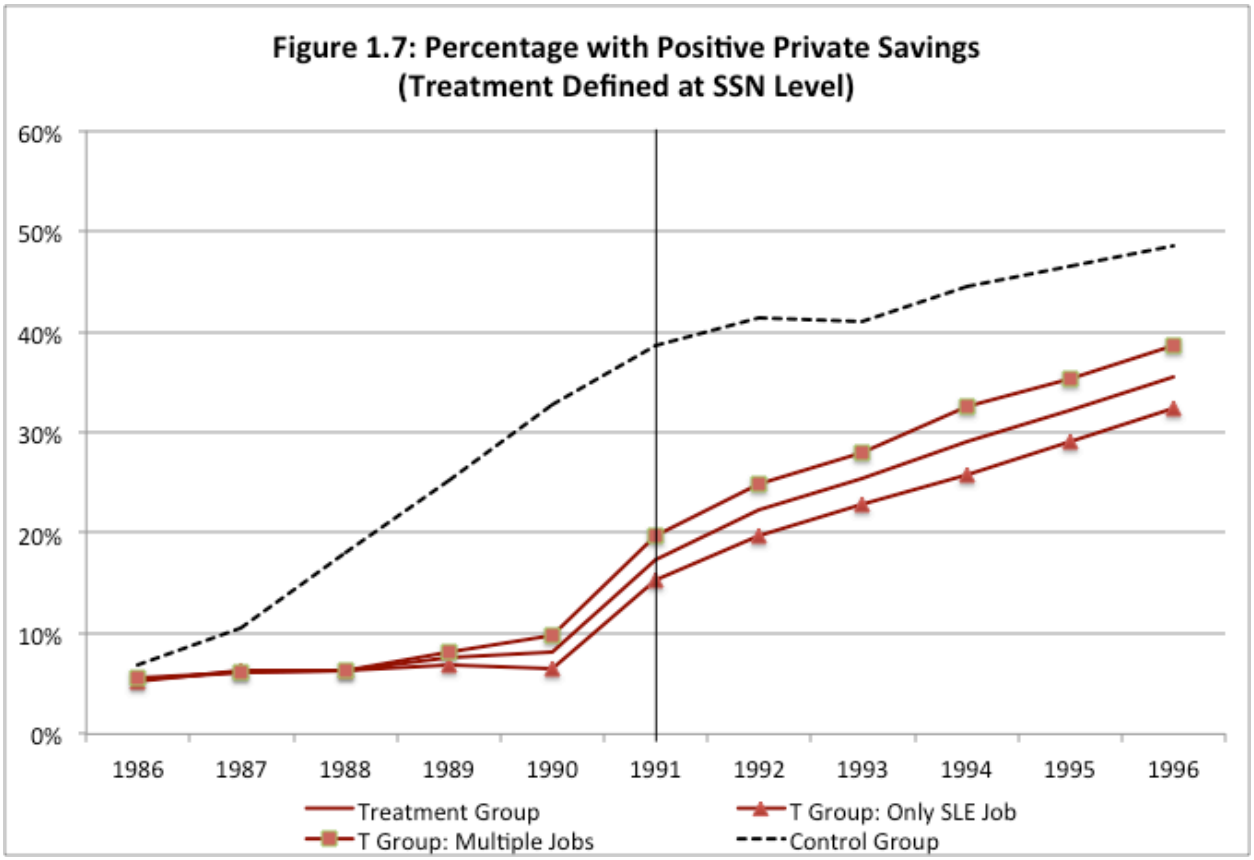
Figure 1.6 illustrates changes in average saving rates across treatment and control groups. If Social Security were crowding out private saving, at a first glance, we would expect that the treatment group's saving rate would decrease relative to the control group's equivalent. Figure 1.6 paints a different picture: Even when we ignore the initial spike in the saving rate, which is

probably due to the tax incentive to contribute in the first half of 1991, it appears that the saving rate is increasing more rapidly for the treatment than the control group after the reform.



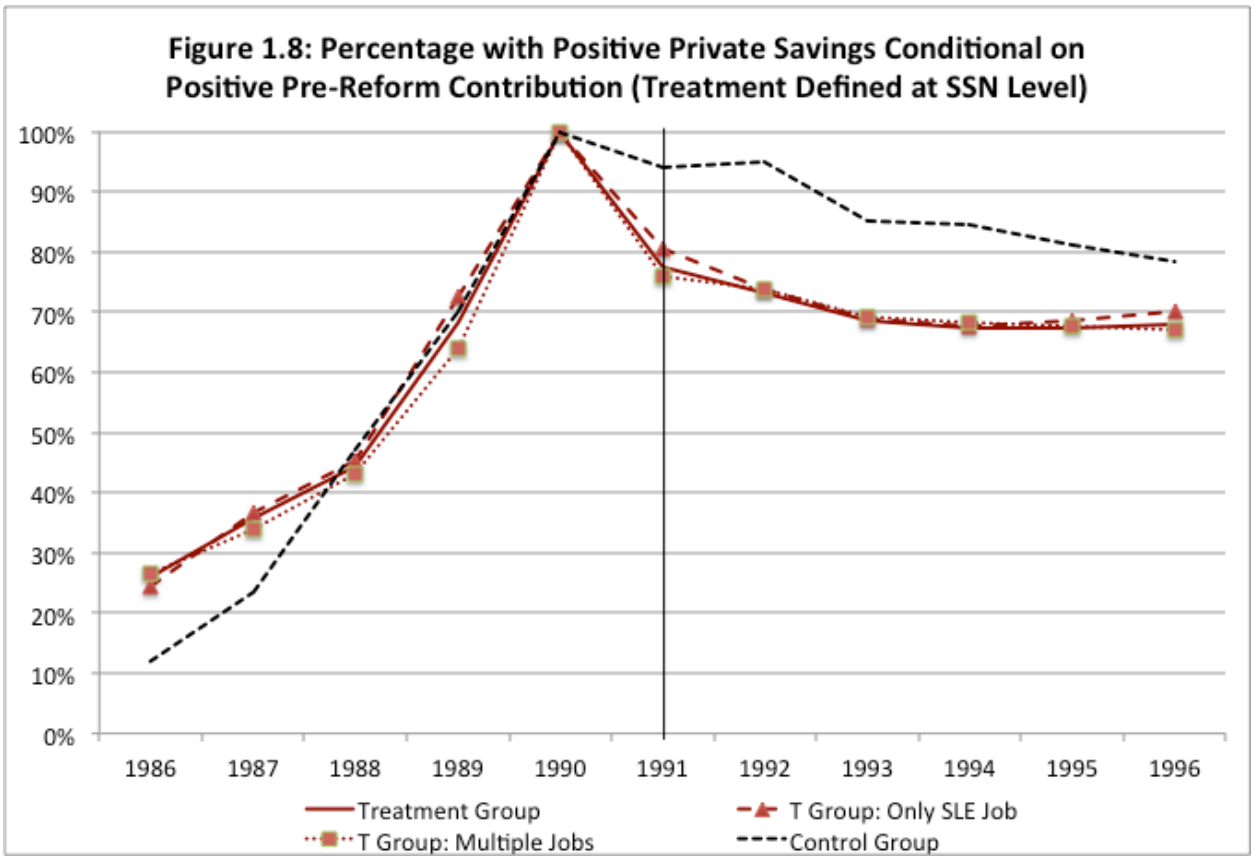
Part of the problem with this methodology of estimating the effect of Social Security on private saving is illustrated in Figure 1.7. The contribution rates to private saving vehicles were very different for treatment and control groups before the reform. While the control group experienced a gradual penetration, from 7% in 1986 to 35% in 1990, the percentage contributing among the treatment group remained relatively stable between 5-10% for the same period. Part of the issue might be that the treatment group was less likely to have access to tax-deferred saving vehicles, which a state and local government did not have to offer to all

its employees. The tax incentive to contribute in the first half of 1991 might have resulted in the marked increase in the fraction of contributors in that year.



Given the differences between treatment and control groups in the fraction of individuals with positive private savings, we now only focus on those with positive private retirement saving contributions in the year prior to the Social Security eligibility reform. Figure 1.8 shows that for this subgroup, pre-reform trends in the extensive margin contributions are similar between treatment and control groups. In the year when the treatment group became newly covered by Social Security (1991) we observe a sharp drop in the percentage of treated individuals who contribute to private retirement savings plans, relative to the control group. Due to mean reversion, the fraction of control group contributors also drops, to 94%. However, the

treatment group drops by 22 percentage points to 78%. If we assume that the 6 percentage point drop for the control group would have materialized also for the treatment group in the absence of the reform, then new Social Security coverage induced approximately 16% of those who were affected and had previously saved in private retirement saving vehicles to stop contributing. Given the unexpected positive wealth shock that expected retirement Social Security benefits represent, we would expect that for some individuals the ideal crowd-out would lead to dis-saving from private saving accounts, or at least to no additional contributions post-reform. Both of our subgroups within the treatment group (those with only an SLE job, and those with multiple jobs) behave similar, and the fraction of contributors, conditional on having contributed before the reform, remains significantly below the control group for all post-reform years shown. This suggests that the reform leads to lasting adjustments in private saving patterns for some individuals affected.



1.4.2 Effect of Social Security on Private Pension Contributions: Intent-to-Treat

A second methodology to analyze the effect of Social Security coverage on private savings defines different degrees of an "intent to treat" at the firm level. I calculate treated as a percentage of uncovered individuals for each firm, and take the median of this percentage across all state and local government employers. All employees of those firms with a below median percentage of treated / uncovered are then defined as having a low intensity of treatment, and are compared to employees in the firms with an above median percentage (high intensity of treatment). Table 1.6 illustrates some summary statistics at the firm level. Out of 86,191 state and local government employers in my sample, there were 2,621 with "treated"

employees, i.e. employees that became newly covered by Social Security. By definition, half of those (1,311) are high-intensity treatment firms. Those high-intensity treatment firms only represent 1,528 SSNs in my sample, compared to 331,060 SSNs employed by the low-intensity treatment firms. This suggests that high intensity treatment employers were substantially smaller, with an implied average of 117 employees in the full population, than the low-intensity treatment firms (implied average of 25,262 employees). This likely reflects the fact that large state and local government employers (e.g. public school systems) were more likely to have covered their employees with state pension plans prior to the reform, thus not necessitating Social Security coverage. Among all firms with treated individuals in my sample, an average of 34% of all employees were treated, or newly covered by Social Security in 1991. Those represented an average of 71% of all uncovered employees. On average, those state and local employers had 24% uncovered employees in 1991, after the reform was implemented. Those 24% represent employees that were covered by equivalent state pension plans and therefore did not need to participate in Social Security.

Table 1.6: Summary Statistics for EIN-level Analysis, 1% MEF Sample

2012 USD

	All SLE Firms	All SLE Firms With Treated	Intensity of Treatment at Firm Level	
			High	Low
# Firms	86,191	2,621	1,311	1,311
# SSN Observations			1,528	331,060
Average % Treated / Total Employees		34%		
Average % Treated / Uncovered		71%		
Median % Treated / Uncovered		71%		
Average % of Uncovered Employees (1991)		24%		
Earnings				
Mean IRS Earnings, 1990			14,112	15,222
Mean Medicare Earnings, 1990			17,011	17,745
Retirement Savings				
% Contributing to Private Retirement Plans, 1990			23.2%	18.9%
Mean Contribution to Private Retirement Plans, 1990			1,778	1,601
Mean Saving Rate, 1990			6.4%	5.7%
Percentage of Earnings from SLE Job				
Mean % Earnings from SLE Job, 1990			71%	73%

Table 1.6 shows that individuals in the high and low intensity of treatment firms were relatively similar in terms of earnings levels: Pre-reform IRS earnings were $14,112 for the high-intensity, and $15,222 for low-intensity treatment groups. A higher percentage of employees at high-intensity treatment firms contributed to private retirement plans prior to the reform (23.2% compared to 18.9%). Those who contributed in high-intensity treatment firms also contributed a higher dollar amount ($1,778 vs $1,601), representing a higher saving rate (6.4% vs 5.7%) in 1990. This is consistent with the higher need to save privately for retirement for the group with a higher percentage of uncovered individuals prior to the reform.

Figures 1.9 and 1.10 illustrate that low- and high-intensity treatment have parallel trends in IRS and Medicare earnings prior to the Social Security eligibility reform. Medicare earnings are higher than IRS earnings on average, the difference representing deferred compensation, or contributions toward private saving vehicles. Note that earnings in these graphs are much

flatter than in the earnings graphs for the SSN-level analysis (Figures 1.2 and 1.3). This is because in Figures 1.2 and 1.3, we are only focusing on individuals who were not uncovered in 1990. Out of this subsample, those that became covered in 1991 are the treatment group, and those who remained uncovered represent the control group. This implies that over time, this group of individuals grows older, and consequently earnings increase. In Figures 1.9 and 1.10, in contrast, we are comparing average earnings for all employees of firms in a particular year. The age composition of the employees represented in each average observation thus does not change as much as in Figures 1.2 and 1.3. We would therefore expect lower growth in the average earnings. Moreover, Figures 1.9 and 1.10 also include employees that were already covered by Social Security prior to the reform, who are entirely excluded when treatment is defined at the SSN level, as in Figures 1.2 and 1.3.

Figure 1.11 illustrates average contributions to tax-deferred saving plans. We observe relatively similar pre-reform trends between low- and high-intensity treatment firms, and a spike in the level of contributions in 1991 for both groups, which might reflect the tax incentive to contribute in that year for treated individuals. However, we do not observe a marked difference between low- and high intensity treatment firms after 1991. The same can be said of Figure 1.12, which shows average saving rates. Those employees in high-intensity treatment firms that had positive private savings contributed a higher percentage of their income to retirement saving plans throughout the period shown on Figure 1.12.

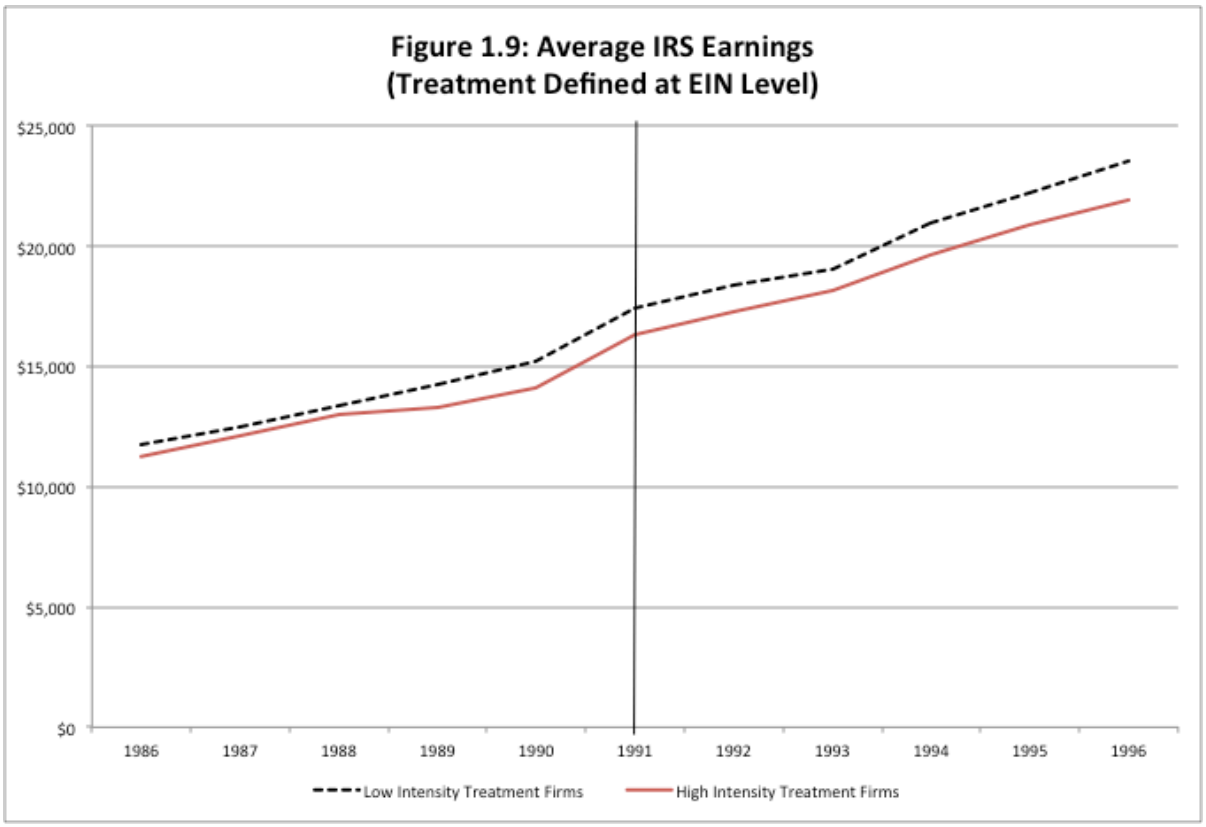


Figure 1.9: Average IRS Earnings
(Treatment Defined at EIN Level)
$25,000
$20,000
$15,000
$10,000
$5,000
$0
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
Low Intensity Treatment Firms
High Intensity Treatment Firms

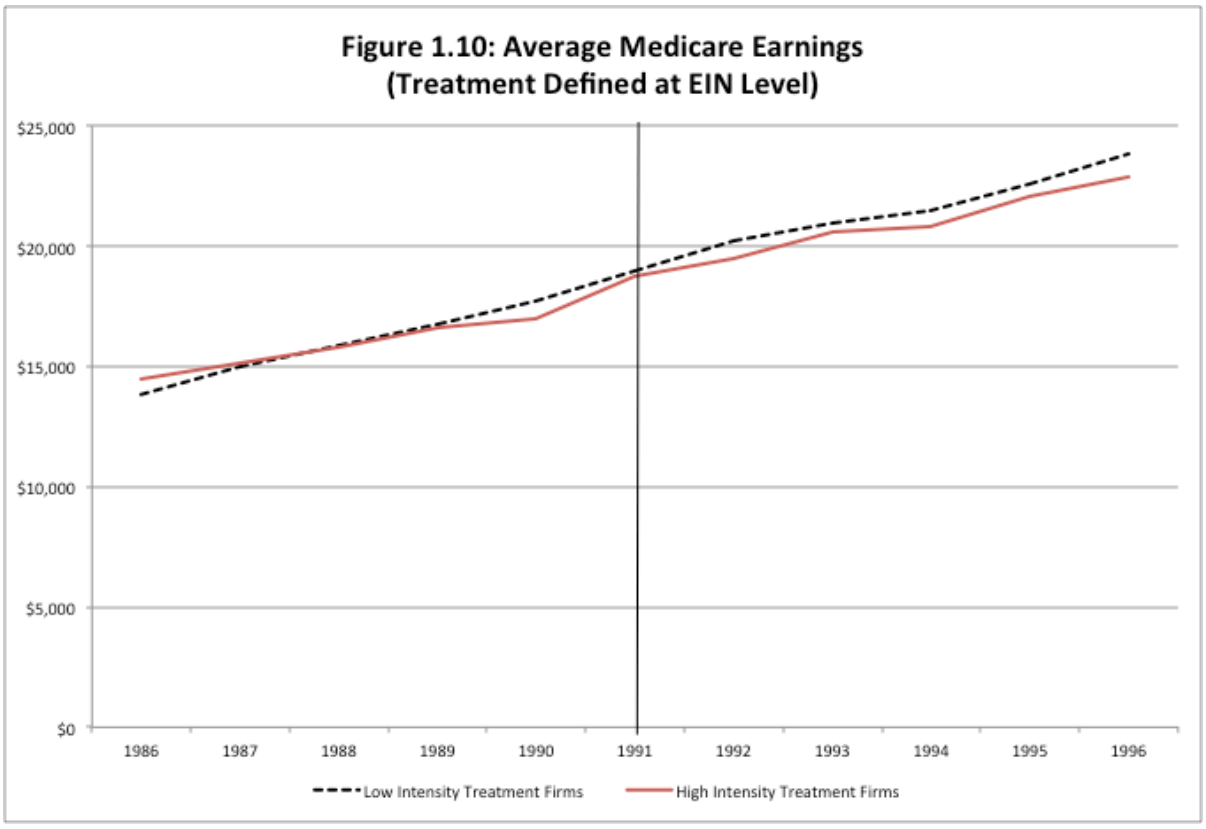


Figure 1.10: Average Medicare Earnings
(Treatment Defined at EIN Level)
$25,000
$20,000
$15,000
$10,000
$5,000
$0
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
Low Intensity Treatment Firms
High Intensity Treatment Firms

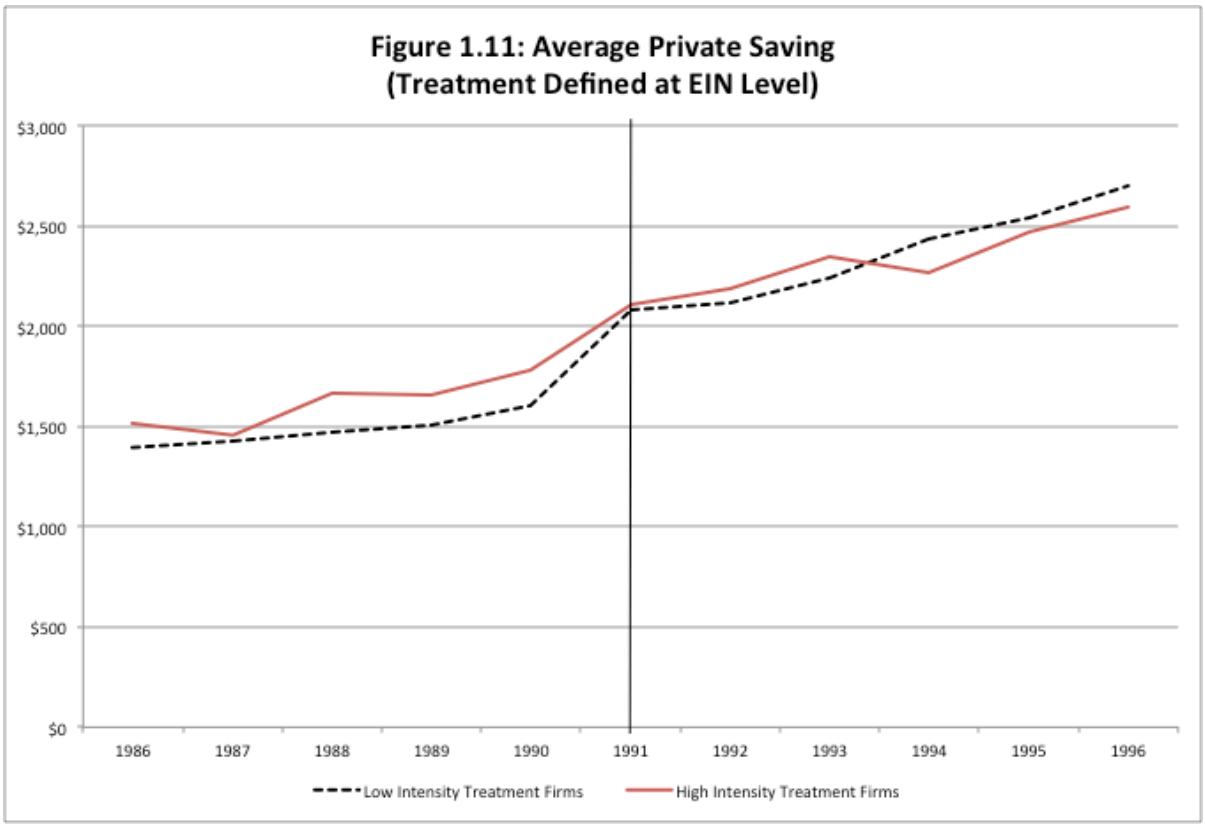


Figure 1.11: Average Private Saving
(Treatment Defined at EIN Level)
$3,000
$2,500
$2,000
$1,500
$1,000
$500
$0
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
Low Intensity Treatment Firms
High Intensity Treatment Firms

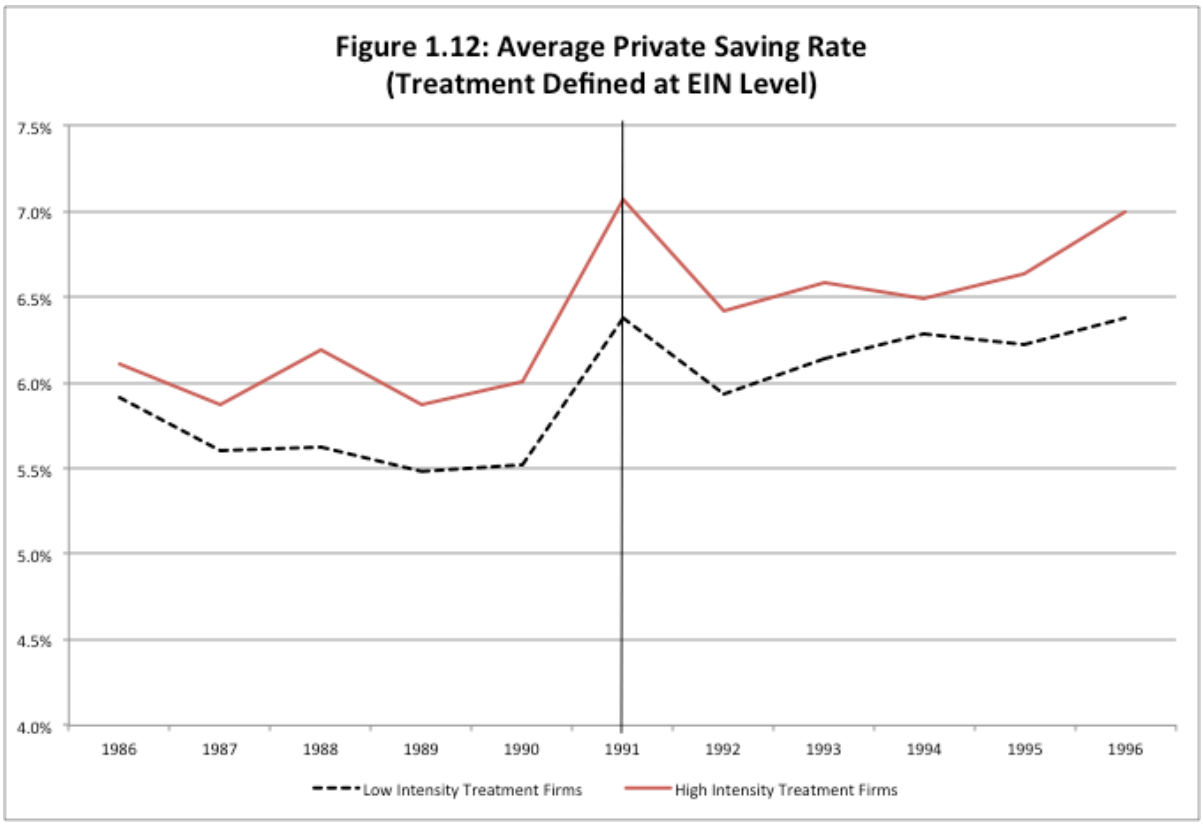
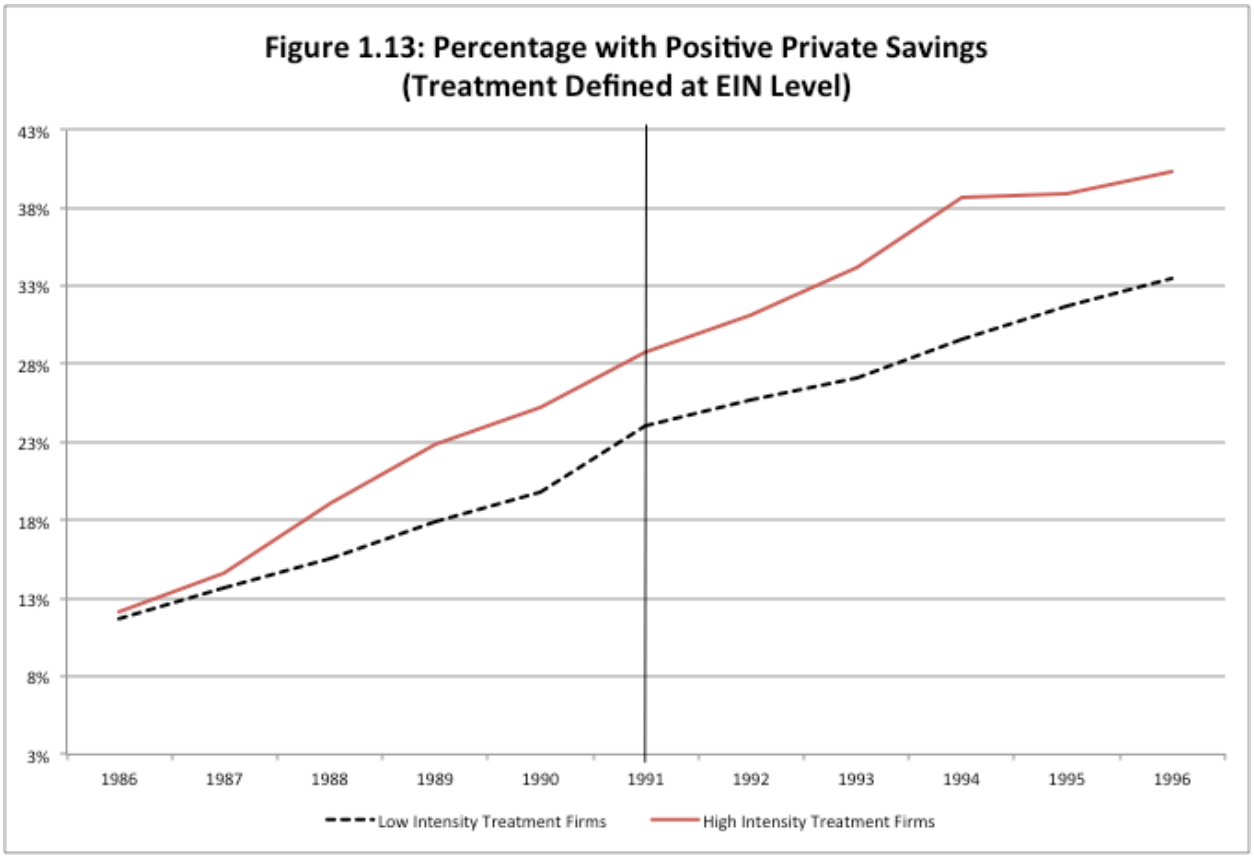


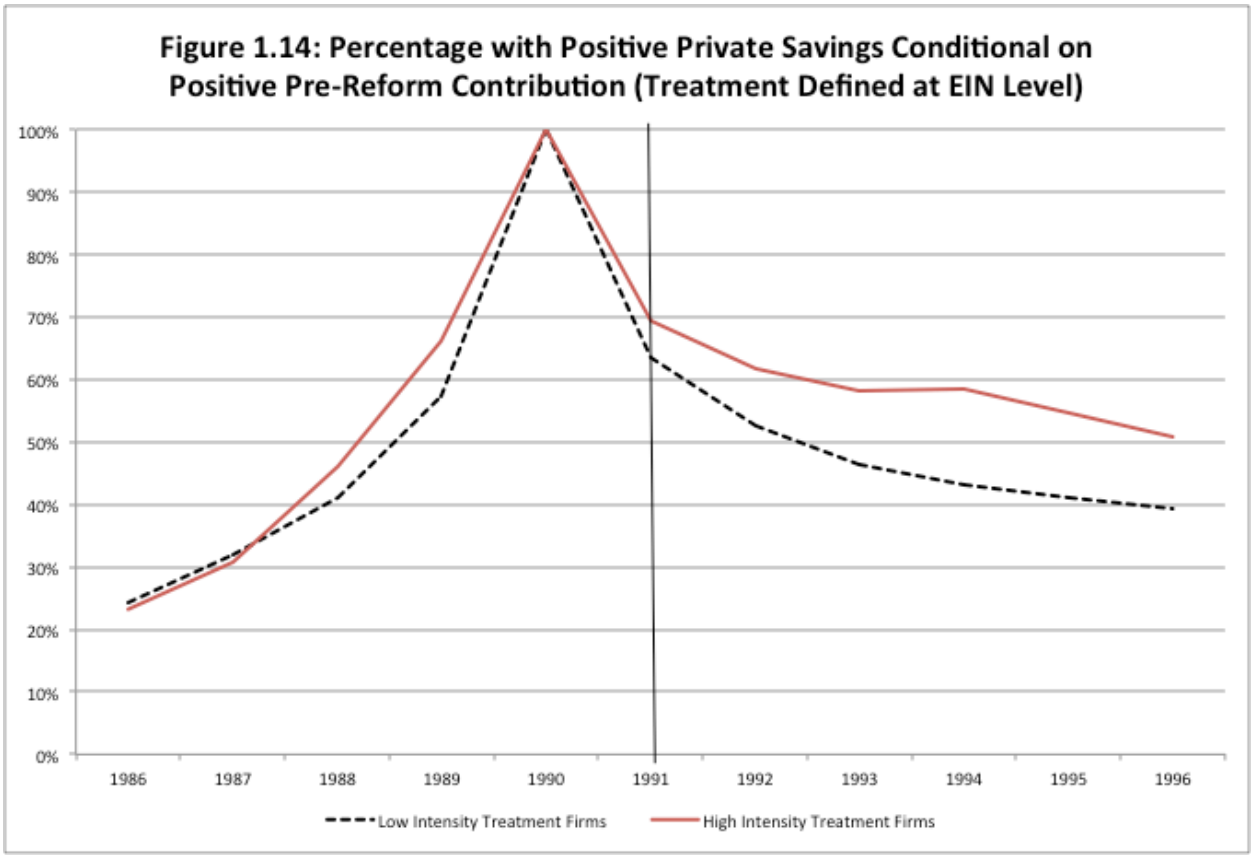
Figure 1.12: Average Private Saving Rate
(Treatment Defined at EIN Level)
7.5%
7.0%
6.5%
6.0%
5.5%
5.0%
4.5%
4.0%
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
Low Intensity Treatment Firms
High Intensity Treatment Firms

Figure 1.13 illustrates the percentage with positive savings in both firm groups. High intensity treatment firms have a faster take-up of private retirement saving vehicles throughout the years preceding the reform. This is consistent with expectation that in high-intensity treatment firms more people needed to rely on private savings for retirement. Post-reform, the growth in the fraction of employees contributing becomes more similar between the two groups. After Social Security coverage, we would indeed expect that both groups should have similar take-up trends.



Contrary to expectation, in Figure 1.14 we do not observe that out of employees that contributed to private saving plans pre-reform, a higher percentage stops contributing in the

high-intensity treatment firms. Rather, we observe the opposite: a larger fraction of 1990-contributors in the low-intensity treatment group stops contributing post-reform.



1.5 Conclusion

This paper analyzed the mandatory Social Security coverage in 1991 of state and local government employees who were not previously covered by an equivalent state pension plan. We use administrative data for earnings, as well as impute an administrative measure of contributions to tax-deferred retirement saving plans.

Two research methodologies produced mixed results on the effect of Social Security coverage on private retirement saving. When comparing individuals who were newly covered to those who had been covered by state pension plans, we observe a marked relative decline in the contributions to private retirement saving vehicles for those newly Social Security covered. However, this methodology suffers from the fact that the two groups have a markedly different likelihood of contributing to private saving plans before the reform, and are thus difficult to compare. Of those who had positive private savings before the reform, we observe that a larger fraction of newly covered individuals stops contributing after the reform, consistent with Social Security crowding out private saving.

A second methodology defines an intent-to-treat at the firm level, based on the percentage of uncovered employees that became newly covered following the reform. This methodology does not provide evidence for a crowd-out of private saving due to Social Security.

Chapter 2

Labor Force Participation, Job Mobility and Earnings Dynamics of Males[14]

[14] This chapter is jointly authored with Jeffrey B. Liebman.

2.1 Introduction

This paper uses data from the Survey of Income and Program Participation (SIPP), matched with Social Security Administration earnings and benefit records, to provide a detailed description of the labor market experiences of men in different education groups across birth cohorts. Using these data, which allow us to observe each worker's annual earnings separately for each employer, we follow individuals from cohorts born in the 1940s-1970s, and analyze when they started working, for how many years they have worked over their lifetimes, how many jobs they have held, their average tenure, and patterns of earnings dynamics. We focus, in particular, on differences between the least educated and other groups, and on trends in the outcomes analyzed across birth cohorts.

The last paper that used administrative data to systematically analyze the above-mentioned dimensions of the labor market experience of American men was Topel and Ward (1992), who studied a cohort of white males born between 1939 and 1948. In this paper, we replicate much of Topel and Ward's (1992) analysis, and update it for recent cohorts. We extend the analysis by considering both differences between the experiences of males with varying education levels, as well as changes across cohorts. We show that many of Topel and Ward's (1992) results mask substantial heterogeneity across education groups, and that the labor market experience of men born in the 1970s are quite different from the experience of the cohort Topel and Ward (1992) studied.

We begin in Section 2.2 by analyzing trends in the age at onset of work, focusing on two measures of first earnings: the first year with any positive earnings and the first year with at least $10,000 (in 2007 dollars) of annual earnings ("significant earnings"). While Topel and Ward (1992) found that 74% of workers in their sample had their first full-time job with significant earnings by age 21, we show that a much lower fraction of college graduates and high school dropouts do so (51% and 68%), and a higher fraction of high school graduates do (82%). We also show that Topel and Ward's (1992) results, which indicate that a majority of workers start making significant earnings by age 21, do not hold true anymore for workers born in more recent cohorts. While 85% (82%) of GED recipients (high school graduates) in the cohort closest to Topel and Ward's (1992) sample achieved significant earnings by age 21, only 45% (70%) of those born in the 1970s did.

Moreover, we also observe a rapid increase across cohorts for the less-educated groups in the percentage of individuals without significant earnings by age 28. Between the 1940s and 1970s birth cohort, the percentage who had not achieved $10,000 annual earnings by age 28 increased from 10% to 19% among high school dropouts, from 1% to 17% for those with a GED, and from 4% to 14% for high school graduates. However, we do not observe a similar increase in the percentage without any earnings at all early in their career. This suggests that while less-educated men have on average started working earlier, just as more educated men have, an increasing fraction of less-educated men are unable to earn enough in the formal sector in their twenties to be self-sufficient. Of those who do not have significant earnings by age 28, we find that a large and increasing fraction is supported by the OASDI and SSI disability programs. In the most recent 1970s birth cohort, 55% of high school graduates, 42% of high school dropouts,

and 29% of GED recipients who lack significant earnings by age 28 are either DI or SSI benefit recipients by the age of 28.

In Section 2.3, we describe trends in years of work over the lifetime across education groups. We find that the number of years worked with significant earnings over the lifetime is relatively stable across cohorts, with a slight decrease for later cohorts at earlier ages. High school graduates work significant jobs for the highest number of years, followed by college graduates, and high school dropouts. In the 1950s cohort, by age 47, high school graduates had on average worked with significant earnings during 21.3 out of 30 possible years (71% of years), compared with 20.5 (68%) for college graduates and 16.1 (54%) for dropouts. High school dropouts also work the least number of years also when considering any earnings. In the 1950s cohort, they worked 21.6 (72%) out of 30 years, compared with 24.9 (83%) for high school graduates, and 24.8 (83%) for college graduates. Looking at the distribution of the number of years worked during the first ten years after receiving significant earnings, we find that more than half of high school graduates work significant jobs for all of the first ten years of labor market experience in the most recent cohort, while less than a third of dropouts do so, indicating significant years of non-employment after the onset of significant work for the least-educated group. However, when we consider any earnings, we show that a large majority of dropouts (67%-73% depending on the cohort) work consistently (at least 8 out of 10 years) during the first ten years, but for many of these years they do not reach the $10,000 threshold that we define as significant earnings.

In Section 2.4 we focus on various aspects of job mobility over the lifetime: cumulative number of jobs held, average tenure, and job exit hazard rates. We find that in all education groups, but in particular among those with lower levels of education, workers have held a larger number of jobs at any given age in more recent cohorts. Dropouts hold the lowest cumulative number of significant jobs at all ages, relative to high school and college graduates, but the highest number of any jobs. By age 58, we estimate that college graduates have held 5.9 jobs with significant earnings, compared with 5.1 jobs for high school graduates, and 4.1 jobs for dropouts. For any earnings, the cumulative job numbers are 16.0, 17.7, and 19.3, respectively. For all education groups, and in particular among high school dropouts, workers have become much more heterogeneous in more recent cohorts in terms of the number of any jobs held, with comparable fractions changing job every year, and holding only one job across the first ten years.

Topel and Ward (1992) estimated that two thirds of all jobs end in the first year. Our results show that those jobs are disproportionately held by the less-educated. Across all cohorts, dropouts have the lowest average tenure at all ages. At age 38, almost half of dropouts have 1 or 2 years of tenure, compared with 35% of high school graduates, and 30% of college graduates. Dropouts also have higher job exit hazards relative to those better educated, particularly at low years of tenure. Across cohorts, average tenure increased between the 1950s and 1960s cohorts for all education groups, but decreased for ages 18-28, and particularly among high school dropouts, between the 1960s and 1970s cohorts.

In Section 2.5 we analyze earnings dynamics over the lifetime. We find that average earnings, excluding those with zero earnings, at early ages have decreased in real terms across cohorts for all education groups, and particularly among high school graduates, GED recipients, and high school dropouts. For high school graduates / GED recipients / dropouts, we observe a 16% / 13% / 24% decrease between the 1950s and 1960s cohorts at age 23, and an additional 7% / 18% / 5% decrease between the 1960s and 1970s cohorts. For college graduates, average earnings at age 23 decreased by 6% between the 1950s and 1960s cohorts, and by an additional 3% in the 1970s cohort. For high school and college graduates some of the decrease in earnings at age 23 may reflect higher levels of enrollment in higher education. Average earnings among high school dropouts are approximately $10,000 at ages 19-22 and level off slightly below $20,000 by age 30.

Topel and Ward (1992) found that average earnings in their sample grew at approximately 11% annually for the first 10 years, and that wage gains at job changes are about 10%, making up approximately half of total wage growth. We show that there is substantial heterogeneity across education group in terms of wage growth, and where it happens. Average real earnings growth, whether within- or between-job, is significantly higher for college graduates than for less-educated groups. While college graduates, on average, experience positive real earnings growth even if they remain with the same employer, earnings of high school graduates and dropouts decrease on average in real terms within the same job and this is true across all age groups. Workers in lower education groups do on average experience earnings growth when they switch jobs. This is particularly true at younger ages, when high school graduates and dropouts gain on average more than 25% in earnings following a job change.

As we have discussed above, the groups with lower education also tend to hold a larger number of cumulative jobs, have lower tenure, and higher job exit hazard rates at all ages. It would be interesting to better understand what it is about these jobs and these workers that does not enable the workers to become more productive and receive greater remuneration as they accumulate more experience.

However, as mentioned before, there is significant heterogeneity among the least educated along all dimensions analyzed. When we exclude the minority with negative nominal earnings growth in our calculations of within- and between-job earnings growth, we find that the remaining high school dropouts have similar earnings growth profiles to those more educated groups, and even experience higher growth rates at older ages. While some high school dropouts progressively lose real earnings when they stay in the same job, change jobs frequently, and remain at low tenure levels throughout their lifetime, others manage to establish stable careers with high tenure, low exit hazards, and surprisingly good real earnings growth starting in their late 20s.

2.2 Data and Sample

We use data from the Survey of Income and Program Participation (SIPP), a nationally representative longitudinal survey of households conducted by the U.S. Census Bureau. Participating individuals are interviewed every 4 months over a period of two to four years. In this paper, we use data from the SIPP panels starting in 1990, 1991, 1992, 1993, 1996, 2001, and 2004. By becoming special sworn Census employees, we were able to match these SIPP

panels to administrative data from the Social Security Administration's Summary Earnings Records (SER), Detailed Earnings Records (DER), the Master Beneficiary Records (MBR), and the Supplemental Security Record (SSR). These administrative data are unaffected by common survey data concerns such as attrition, misreporting, or non-response, and provide panel data for respondents in the SIPP on their lifetime history of earnings and benefits received. The SER covers aggregate annual earnings for all individuals covered by Social Security from 1951 to 2007, capped at the Social Security taxable maximum. The DER starts in 1978, and includes annual employee-employer earnings records. In contrast to the SER, the DER also includes uncovered earnings, and earnings are not top-coded. We exclude self-employment earnings in our analyses. The MBR and SSR files provide data on Old-Age, Survivors, and Disability Insurance (OASDI) and Supplemental Security Income (SSI) benefits, including both retirement and disability benefits.

Match rates between the SIPP and the administrative earnings files are in the low 80 percentage range for panels that started in the 1990s, but dropped sharply for the 2001 (53%) and 2004 (68%) panels. Our match rates mirror those found in other studies using SIPP-SSA matched data (Czajka et al. (2008), Davis and Mazumder (2011)). The main reason for non-matches is that some respondents do not provide a Social Security Number, or the number they provide is not valid. Czajka et al. (2008) calibrated the matched samples of the 2001 panel to the same demographic controls that the Census Bureau uses to calibrate the full sample, and found little evidence of bias in the estimates of a wide range of characteristics. Nevertheless, we adjust for the probability of match to an administrative record by reweighting our sample.

We create match weights using predicted coefficients from logit regressions of the probability of having a match in the SER/DER data on a rich set of observables from the SIPP.[15]

Table 1: Sample Sizes by Birth Cohorts and Education Groups

Sample Sizes

	Birth Cohorts				
	Topel&Ward	Cohort 1	Cohort 2	Cohort 3	Cohort 4
	1939-1948	1940-1949	1950-1959	1960-1969	1970-1979
All Males	16,251	17,041	23,192	18,717	4,750
White Males	14,341	15,043	20,297	16,204	4,016
Male College Graduates	4,886	5,289	6,353	4,888	1,263
Male Some College	2,978	4,286	6,772	5,243	1,585
Male High School Graduates	4,279	4,363	6,685	5,572	1,133
Male GED Recipients	525	535	717	648	266
Male High School Dropouts	2,265	2,238	2,222	1,977	368
Less Than 26 Yrs at Interview				3,463	11,356

Distribution of Education Groups

	Birth Cohorts				
	Topel&Ward	Cohort 1	Cohort 2	Cohort 3	Cohort 4
	1939-1948	1940-1949	1950-1959	1960-1969	1970-1979
Male College Graduates	30%	32%	27%	25%	29%
Male Some College	23%	24%	27%	26%	30%
Male High School Graduates	30%	29%	33%	34%	23%
Male GED Recipients	2%	2%	2%	2%	4%
Less Than 26 Yrs at Interview	15%	14%	11%	13%	14%

Ages Observed in Administrative Data

	Birth Cohorts				
	Topel&Ward	Cohort 1	Cohort 2	Cohort 3	Cohort 4
	1939-1948	1940-1949	1950-1959	1960-1969	1970-1979
Ages For Which Full Cohort Observed in SER	12-59	11-58	1-48	0-38	0-28
Ages For Which Full Cohort Observed in DER	39-59	38-58	28-48	18-38	8-28

[15] We use the following explanatory variables in the logit regressions that create the match weights: gender, race dummies, age, 2nd, 3rd, 4th, and 5th degree polynomials of age, a dummy for being enrolled in school or a degree program, a dummy for years of education, dummies for marital status, a dummy for positive earnings, 2nd , 3rd, and 4th degree polynomial of annual earnings, a dummy for living in a metropolitan area, a dummy for means-tested cash or non-cash receipt, and a dummy for disability status. We multiply the resulting match weights with the regular SIPP weights to create our final weights.

For the purposes of our analysis, we define samples across two dimensions: birth cohorts and education categories. We exclude all foreign-born individuals, given that we cannot observe a lifetime earnings histories for most of them. We begin with the birth cohort that Topel and Ward (1992) analyzed, born between 1939 and 1948. We replicate several findings in this cohort for white males only, mirroring their sample. For the remainder of the paper, we focus on four birth cohorts, each spanning ten years: cohort 1, born from 1940-1949, cohort 2, born from 1950-1959, cohort 3, born from 1960-1969, and cohort 4, born from 1970-1979. Table 1 illustrates ages for which we observe administrative earnings data in each cohort, given that we have access to SER data from 1951 to 2007, and DER data from 1978-2007. We can observe cohort 1 across most of the work life (the full cohort can be observed from ages 12-59 in the SER). However, for any analysis that required employee-employer records from the DER, we only begin observing this cohort at age 38. The most recent cohort 4 can be fully observed from birth until age 28. In our graphs and tables that are based on DER data, we therefore analyze age groups between 18-28, 18-38, 28-48, and 38-58, which refer to the ages that are fully observed in our four cohorts.

For most of the paper, we focus on jobs held at ages 18 and older. However, when analyzing the age at onset of work, we consider all jobs that begin at age 16 or later

Despite the high quality of the SER and DER data relative to survey data on earnings, we should highlight the potential bias introduced to our analysis by the fact that the SER, our only source of administrative earnings data from 1951-1977, does not include work that was not covered by Social Security. We thus observe all employment starting only with the 1960s cohort (the oldest

of whom are 18 in 1978 when the DER file with all earnings begins). In particular, there is a bias stemming from occupations that remained uncovered until at least 1978, and which are thus not included in our earnings data prior to 1978, but are included thereafter. In 1977, approximately 12% percent of workers were not covered by Social Security[16]. Nearly all of these were government workers. However, some government work was covered by Social Security prior to 1978 through agreements between individual states or municipalities and the Social Security Administration, and related earnings were thus visible to us in the SER prior to 1978. Between 1951 and 1978 there were several extensions in Social Security coverage, which might bias the analysis for the 1940s and 1950s cohorts: (1) In 1955, self-employed farm workers, self-employed professionals, and home workers became covered. (2) In 1956, members of the uniformed services on active duty became covered. (3) In 1965, interns and self-employed physicians became covered (Olsen and Hudson (2009)). The first two coverage extensions do not affect our results, given that even the oldest person in our sample, someone born in 1939 (relevant for our analysis replicating Topel and Ward (1992)), would have been only 16 and 17 by the year the coverage changes were enacted. The third coverage extension is relevant and might introduce a bias for the 1940s cohort. Someone born in 1940, who for instance began working as an intern in his early 20s, would only appear in our data as starting work in 1965, at age 25. However, the percentage of our sample affected by this extension is very small.

Throughout this paper, we deal with the covered worker problem in two ways: In some cases, we offer alternative versions of analyses, in which we exclude uncovered work also for the period from 1978-2007. In other cases, we restrict ourselves to the 1960s and 1970s cohorts,

[16] Source: Nelson (1985).

which we can observe from the start of their careers in the DER, where earnings from all employers are included.

On the education dimension, we divide the sample into five mutually exclusive education categories: college graduates (also including respondents who received degrees beyond a bachelor), some college (including respondents with any type of education beyond high school, but below a bachelor degree), high school graduates, GED recipients (including only those GED recipients who did not receive further education beyond the GED), and high school dropouts (including only high school dropouts who did not subsequently pursue further education, such as a GED). In order to be included in any of those categories, the respondent needed to be at least 26 years old by the time of the SIPP interview, in which he was asked questions from the topical module on education history. This implies, for example, that for cohort 4, born from 1970-1979, we use observations only from the 1996 SIPP panel onward. This procedure drops 16% of potential observations for cohort 3 (born 1960-1969) and 71% for cohort 4 (born 1970-1979) (see Table 1.1 for more details on sample sizes).

For most of the analysis, we show our findings on labor force participation and job mobility for two different definitions of earnings: annual reported earnings greater than $0, and annual reported earnings greater than $10,000 (in 2007 USD). We refer to the former will be referred to as “any work”, and the latter as “significant work”. The second definition is meant to approximate a cutoff for work with non-negligible. It also mirrors Topel and Ward (1992), who used quarterly earnings data from the Longitudinal Employee-Employer Data (LEED), and assumed that an individual worked full-time in a given quarter if he earned at least 70% of the

minimum quarterly wage during that quarter. Our definition of significant implements a similar procedure to annual earnings data[17]. Table 1 in the appendix shows the 2007 USD equivalent of 70% of annual earnings that an employee would earn when working a full-time job at each year's minimum wage for the years 1951-2007. The threshold varies over the period, increasing from around $8,500 in the 1950s until approximately $13,800 at the peak in the late 1960s, and then decreasing again to $8,500 by 2007. The median for the threshold over this period is $9,734, which is close to the $10,000 cutoff that we chose for the purposes of our analysis.

2.3 Labor Force Participation Over the Lifetime

Empirically, the correlation between labor market experience and earnings is well established. Theory has offered different explanations. Human capital theory, starting with Mincer (1958), suggests that individuals with more experience have a more general human capital, and are therefore more productive. Search models imply that individuals with more experience have a higher probability of finding a better match, and thus experience relatively higher earnings (Burdett (1978), Jovanovic (1984)). Independently of the channel, given the empirical importance in predicting earnings outcomes, it is crucial to understand dynamics in the accumulation of labor market experience. The following section will describe both when individuals enter the work force, and for how many years they work across their work life. We will focus on differences across education groups, as well as over time.

[17] From 1951 to 1977, employers reported covered earnings quarterly. Since 1978, employers report both covered and uncovered earnings on Form W-2, but only on an annual basis. (Compson 2011)

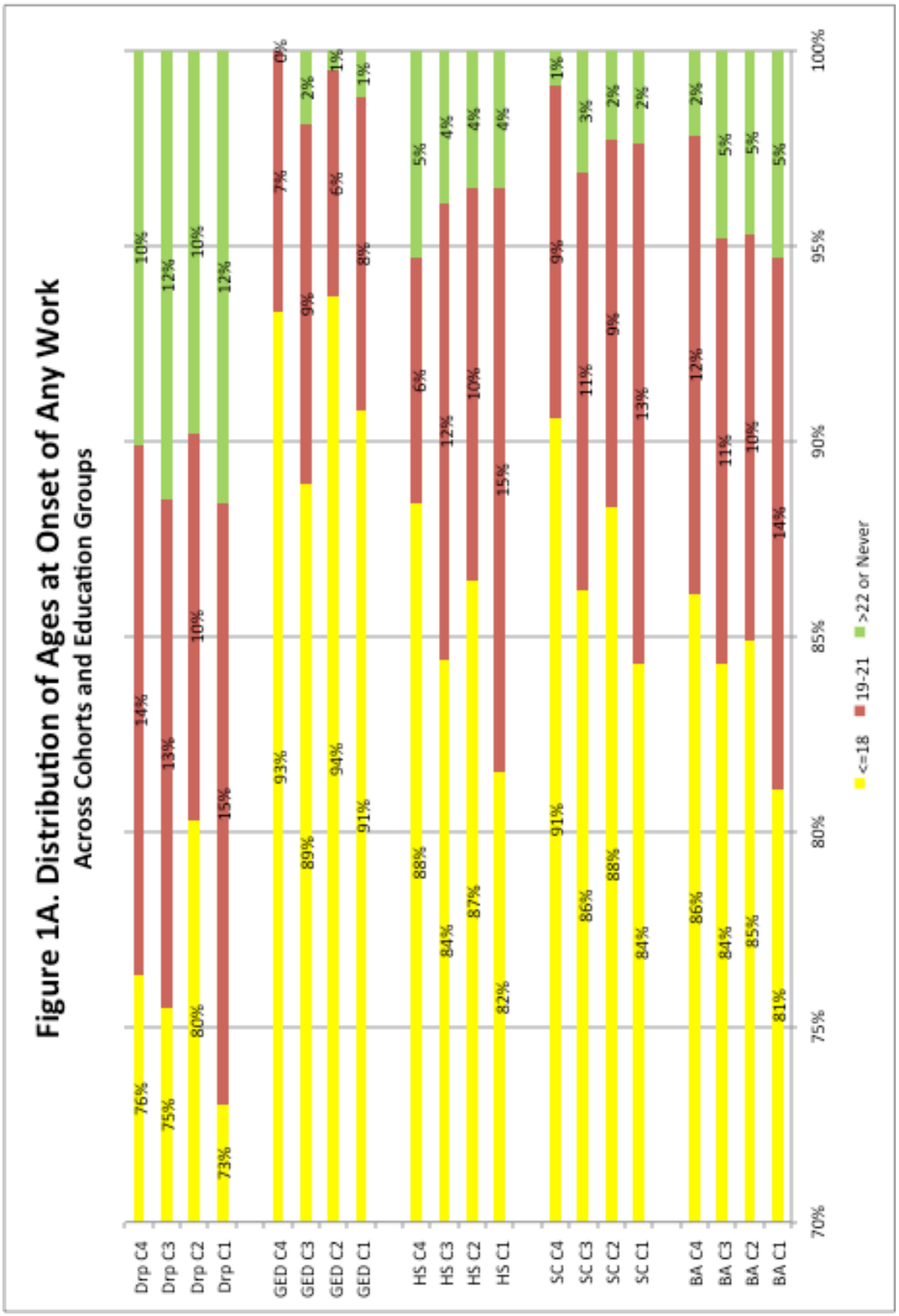
2.3.1 *Age at Onset of Work*

Figures 1A and 1B illustrate the distribution of age at first positive, and first significant earnings, respectively[18]. Figure 1A shows that a large majority of individuals have held some job by age 18, though we observe heterogeneity across education groups. High school dropouts start working relatively later than better-educated groups. In the latest cohort born in the 1970s, 76% of dropouts had held a job by age 18, compared to 93% of GED recipients, the group with the largest fraction of early entrants into the labor force. By age 22, 10% of dropouts had not yet started working, compared to a rounded 0% for GED recipients. This implies that GED recipients are different from the remaining high school dropouts, and more active in the labor market, already before the decision to obtain a high school equivalency credential. In fact, the data suggest that those who later go on to earn a GED dropped out of high school to start working, while many of the remaining high school dropouts appear not to start working until several years later[19]. Across cohorts, a higher fraction of individuals in all education groups have started working earlier, in particular when compared to the 1940s birth cohort.[20] For example, 81% of college graduates born in the 1940s had held a job by age 18, which increased to 86% for the 1970s birth cohort. The fraction of individuals who entered the labor force before age 22 did not change significantly across cohorts.

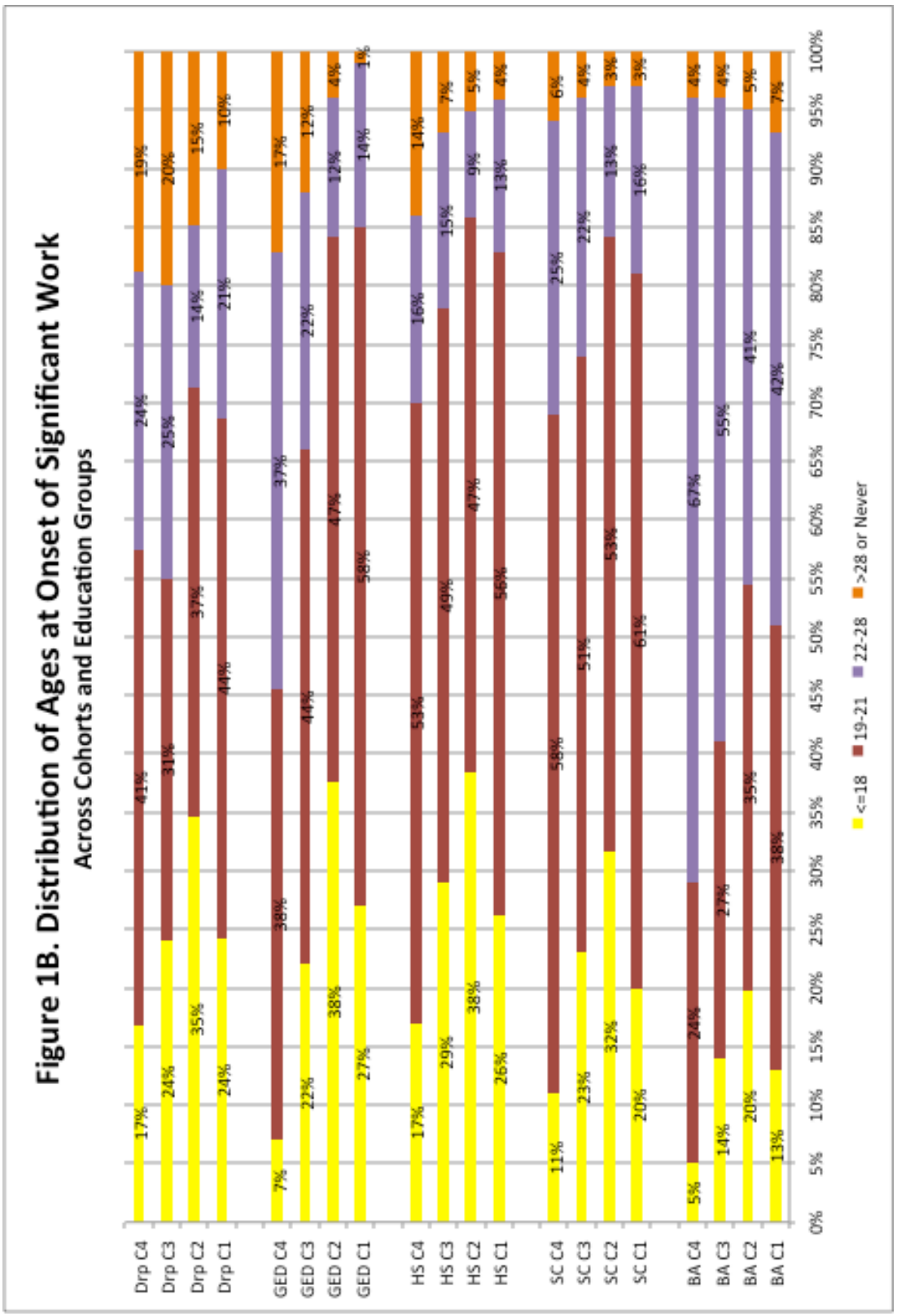
[18] We consider all jobs that begin at age 16 or later in this section.

[19] This might be partly explained by high school dropouts starting to work in the informal sector, and the high proportion of dropouts who are incarcerated in early life (Pettit and Western (2004)).

[20] It is unlikely that the sharp increase between the 1940s and 1950s birth cohorts in the fraction of high school dropouts who have held a job by age 18 can be explained by sample changes due to extensions of Social Security coverage to interns and self-employed physicians in 1965 (as explained above, this is the only extension that could affect our results), or by inclusion of government employees starting in 1978, as those occupations are not typical for high-school dropouts.



Note: “Drp” refers to high school dropouts, “GED” to GED recipients, “HS” to high school graduates, “SC” to some college, and “BA” to college graduates. C1 to C4 refers to consecutive cohorts, born between 1940-1949 (C1), 1950-1959 (C2), 1960-1969 (C3), and 1970-1979 (C4).



Note: "Drp" refers to high school dropouts, "GED" to GED recipients, "HS" to high school graduates, "SC" to some college, and "BA" to college graduates. C1 to C4 refers to consecutive cohorts, born between 1940-1949 (C1), 1950-1959 (C2), 1960-1969 (C3), and 1970-1979 (C4).

Figure 1B illustrates the distribution of ages at the onset of significant earnings (>=$10,000 annually). High school graduates and those with some college but no bachelor degree are have significant earnings relatively earlier than other groups, with around 70% achieving significant earnings by age 21 in the 1970s cohort. Among college graduates, this fraction is lower, likely due to still being in college or subsequent training.

Although most people hold some job very early in life as seen in Figure 1A, Figure 1B shows that for many of them it takes significantly longer to make significant earnings. For example, only about a fourth (22%) of the high school dropouts who had started working by age 18 in the 1970s birth cohort (76%) had gained significant earnings by that age (17%). This proportion is even lower (8%) for GED recipients in the same cohort. Although a larger proportion of GED recipients start working at early ages relatively to the remaining dropouts, fewer of them achieve significant earnings early in all cohorts.

Age at first significant earnings has increased over time for dropouts and GED recipients. Across cohorts, Figure 1B shows that concurrently a lower percentage of dropouts and GED recipients started working a significant job before age 21, with the percentages starting between ages 22-28 increasing. This suggests that individuals who would have started significant work quite early in earlier cohorts are now postponing the onset of significant work until their late twenties or possibly even later. The change is particularly drastic for GED recipients: while in the 1940s birth cohort, 85% had begun significant work by age 21, the equivalent was only 45% for the 1970s birth cohort. Of the 40 percentage point change, 23 percentage points can be explained by individuals who instead of starting by age 21 now start working significant jobs between

ages 22 and 28. However, the remaining 17 percentage points refer to GED recipients who defer their first significant earnings beyond age 28, or in fact never achieve them. In the later cohorts, GED recipients thus look much more similar to high school dropouts than in earlier cohorts in terms of their average age at first significant earnings.

In contrast, fewer college graduates begin significant work after age 28 over time (decrease from 7% in 1940s cohort to 4% in 1970s cohort). However, college graduates also appear to postpone their first significant earnings, with fewer BAs achieving this level before age 22, and more between ages 22-28 in later cohorts.

Figure 1B also illustrates a striking trend across cohorts for all education groups except college graduates: An increasing fraction of individuals do not have significant earnings by age 28. This is particularly true for the less-educated groups. The percentage of individuals who had not begun making significant earnings by age 28 has increased rapidly and consistently from the 1940s to the 1970s birth cohorts: from 10% to 19% for high school dropouts, from 1% to 17% for GED recipients, and from 4% to 14% for high school graduates.

Topel and Ward (1992) showed that of all white males they observed working (born between 1939 and 1948), 22% started by age 18, another 52% between ages 19 and 21, 24% between ages 22 and 24, and the rest between 25 and 33, the maximum age that Topel and Ward observe in their data. We are able to match those percentages relatively closely for white males when considering the same birth cohort, and only for the years that Topel and Ward (1992) observe earnings data (until 1972). Replicating the same analysis without the restriction on years of data considered shows that Topel and Ward (1992) underestimated the percentage of

white males who began first significant work between ages 25 and 33, as they did not observe everyone in the sample until age 33: rather than their estimate of 3% in that age group, we find that 7% started significant work in that age category.

Our analysis also highlights that Topel and Ward's (1992) results are masking substantial heterogeneity by education. Topel and Ward (1992) estimate in their sample of white males that 74% start working their first full-time job by age 21. In cohort 1, closest to the Topel and Ward (1992) sample, we find that only 51% of college graduates, and 68% of high school dropouts start their first full-time job with significant earnings by age 21, but 82% of high school graduates.

Figure 1B also shows that Topel and Ward's (1992) estimates of the age at the first full-time job do not hold true for more recent cohorts. The fraction of workers achieving significant earnings by age 21 decreased substantially for all education groups apart from high school dropouts from the cohort that Topel and Ward (1992) analyzed, to the cohort born in the 1970s. While 51% (82%, 85%) of college graduates (high school graduates, GED recipients) born in the 1940s made significant earnings by age 21, only 29% (70%, 45%) of those born in the 1970s did so.

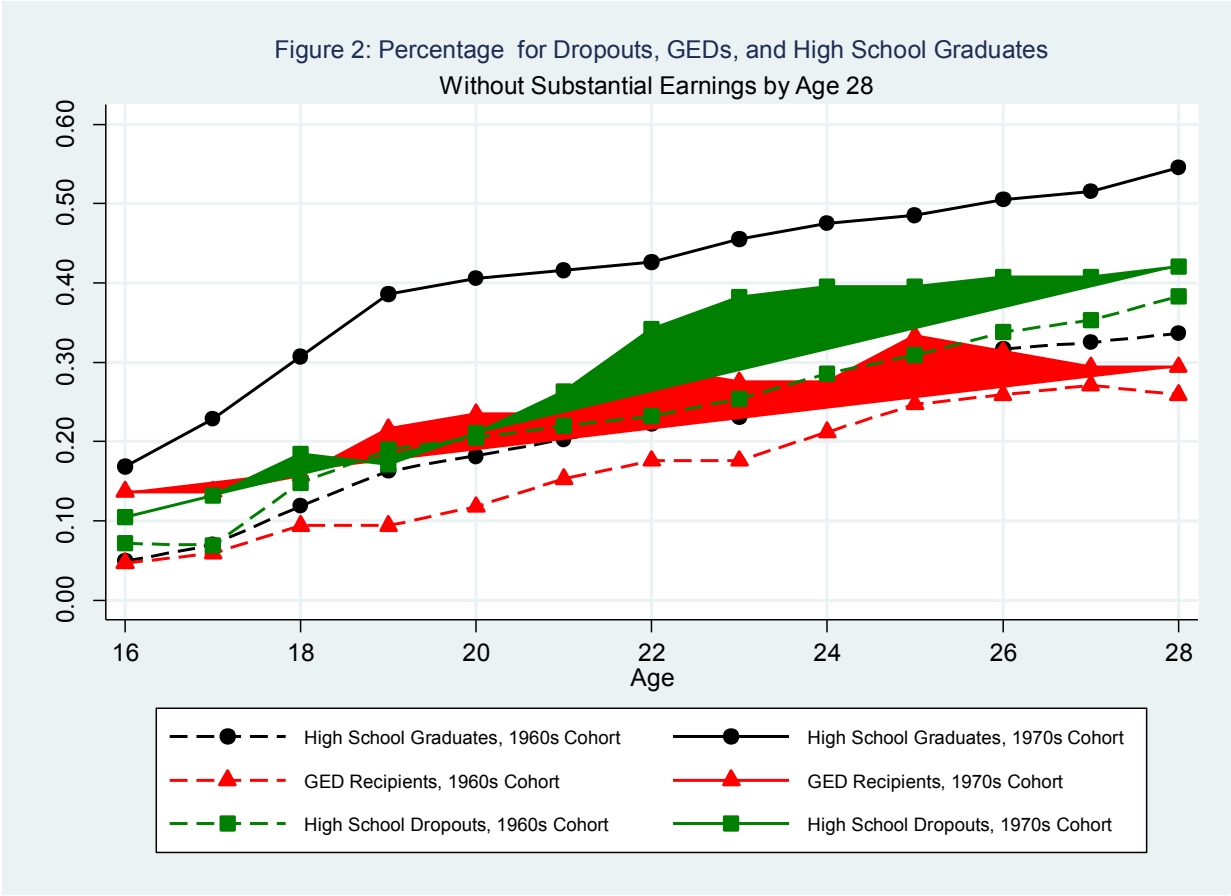
In addition, because Topel and Ward (1992) restricted their sample to individuals who had at least some positive earnings during their sample period, their results fail to capture some important differences by education in the extensive margin of labor force participation during individuals' late teens and twenties. Figure 1B shows that in the 1940s birth cohort, closest to Topel and Ward's (1992) cohort, 10% of high school dropouts had not earned significantly until age 28, compared with only 1-4% for GED recipients, high school graduates, or those with some

college years. The equivalent percentage for college graduates is 7%, which is likely explained by individuals pursuing further education beyond a bachelor degree before entering the labor force full-time.

Given that such a large proportion of less-educated individuals does not earn significant incomes in their twenties, the question arises to what extent this population is relying on public assistance to survive. Figure 2 shows the share that receive DI or SSI benefits for less-educated groups who never had significant earnings in any year by age 28.[21] The figure illustrates that a significant fraction are supported by DI or SSI: In the 1970s birth cohort, 55% of high school graduates, 42% of high school dropouts, and 29% of GED recipients are either DI or SSI benefit recipients by the age of 28. Most of these individuals became recipients already by age 22. In addition, GED recipients rely much less on public support than high school dropouts. To summarize differences between these two education groups, in the 1960s cohort 20% of dropouts never achieved significant earnings (see Figure 1B), 12% never had any earnings by age 28 (see Figure 1A), and 38% were DI or SSI recipients. In contrast, 12% of GED recipients never achieved significant earnings, 2% never had any earnings by age 28, and 26% were DI/SSI recipients. Third, reliance on disability benefits has increased significantly between the 1960s and 1970s cohorts, particularly for high school graduates. While 34% high school graduates in the 1960s birth cohort received DI or SSI benefits, this number increased to 55% for the 1970s cohort. Figure 1B showed an increase in the percentage of workers who do not earn significant

[21] Data on DI and SSI receipt is administrative from the SSA's MBR and SSR files, available starting in 1974. We can therefore only follow early benefit receipt for the 1960s and 1970s birth cohorts.

earnings by age 28 across the most recent cohorts. Figure 2 shows that an increasing fraction of those survive due to public assistance in the form of disability insurance programs.



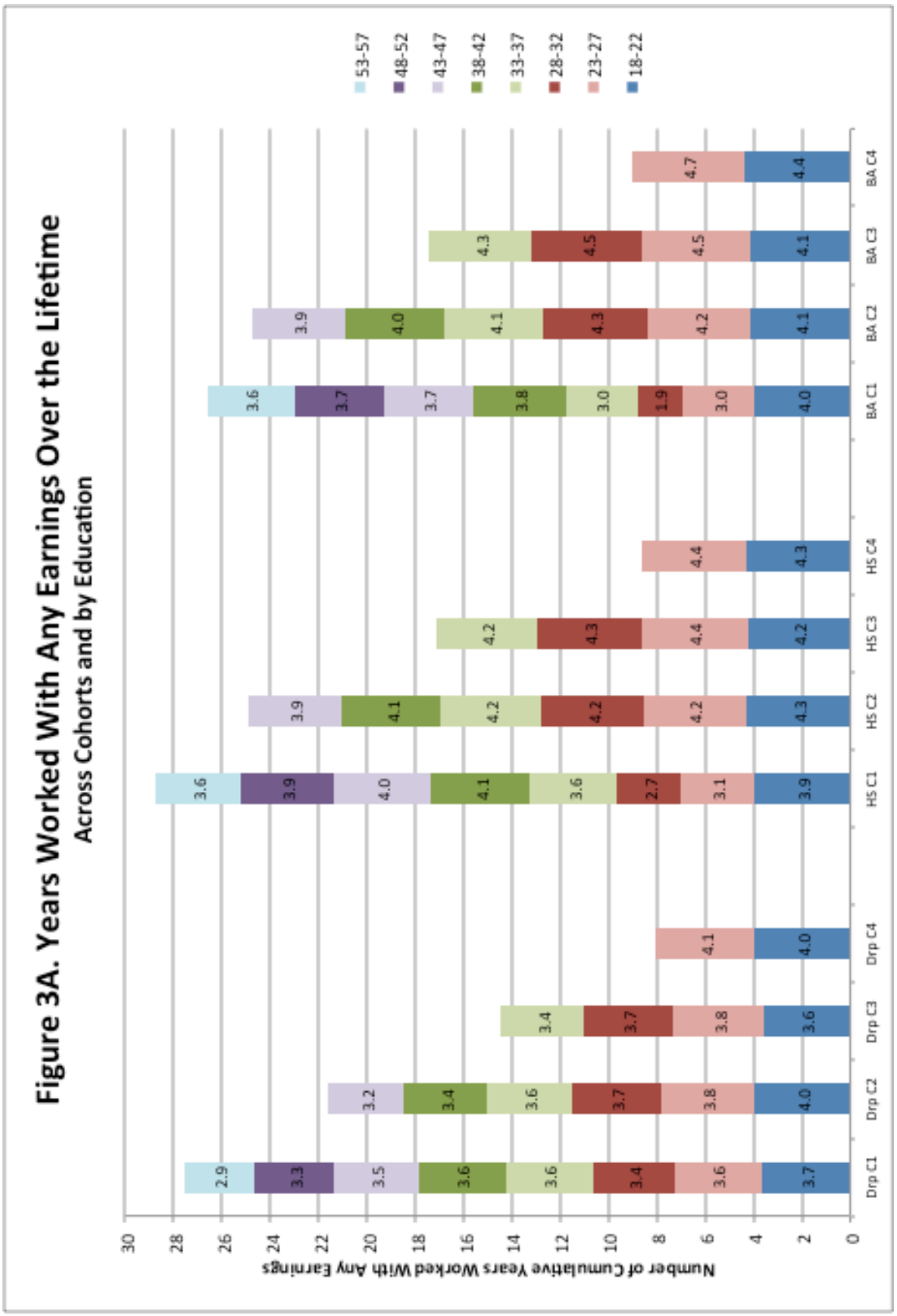
2.3.2 *Years of Work over the Lifetime*

Experience, which we know to be a crucial input for earnings progression, is determined both by age at onset of work, which we discussed in section 2.3.1, and by labor force participation

thereafter, the subject of the current section. We will examine how much different education groups work across their lifetime, and how this has varied across cohorts. [22]

Figure 3A illustrates cumulative number of years worked for individuals across our four cohorts, separately for college graduates, high school graduates, and high school dropouts. Each stripe in the stacked bars represents the average number of years worked in the particular 5-year age category. The stacked bars for the more recent cohorts do not include all age groups, as we do not observe individuals up to the higher ages. For college and high school graduates, we observe a large difference between cohorts 1 and 2, i.e. those born in the 1940s and the 1950s. Cohort 2 works for more years in the age groups up to and including ages 33-37. This difference is likely due to the fact that uncovered work, and in particular government jobs, are not included in our data until 1978. Cohort 1 is aged 33-37 between the years 1973-1982, and thus about half of the observations for cohort 1 in that age group exclude uncovered work. In older age groups, which are not affected by this data issue, we do not observe a significant difference between cohorts 1 and 2. We also do not see this issue for high school dropouts, given that this group is unlikely to work in government employment.

[22] For this, and all following analyses, we consider jobs held starting at age 18. For most following analyses, we also focus only on college graduates, high school graduates, and high school dropouts for ease of presentation.



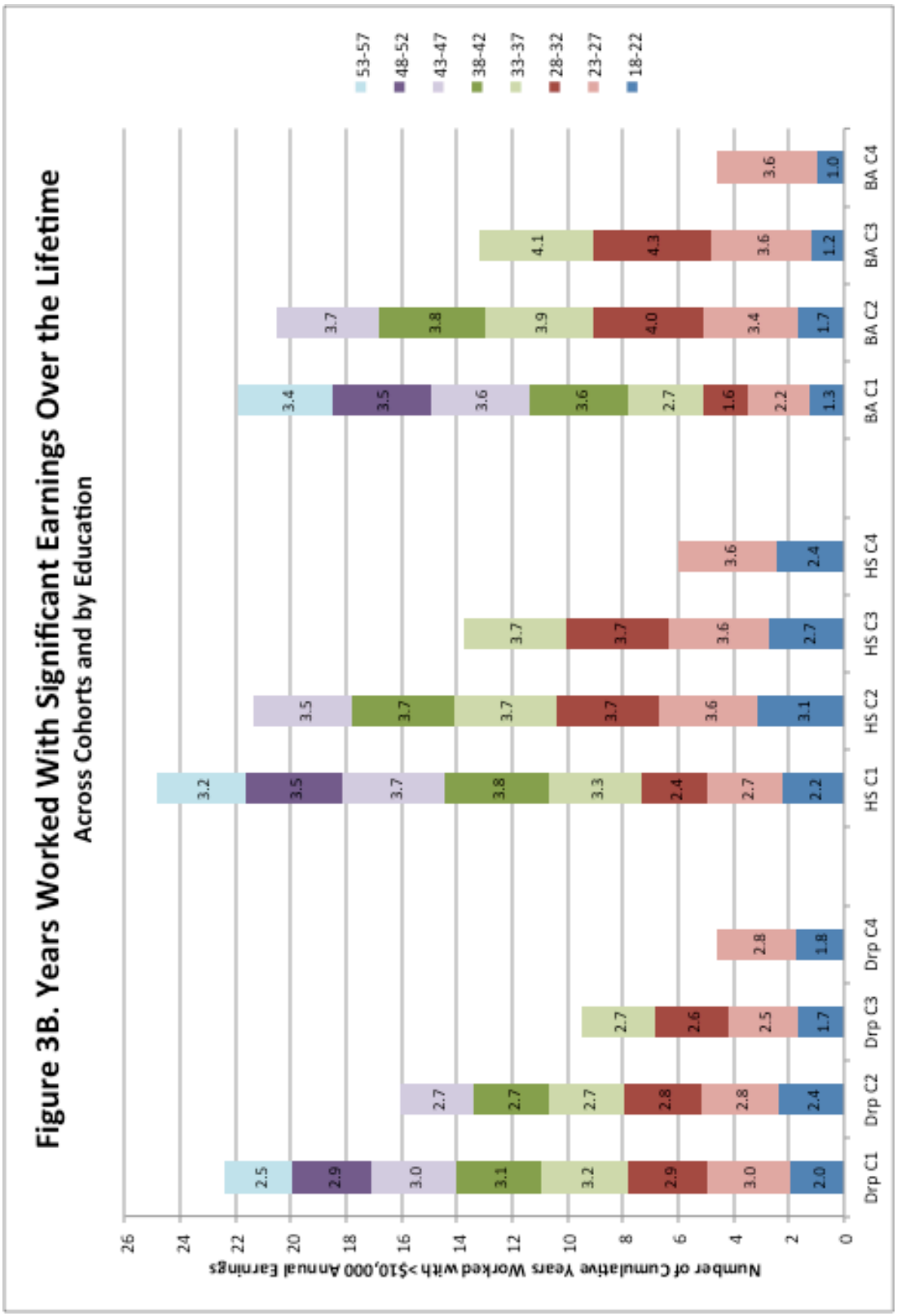
Note: "Drp" refers to high school dropouts, "HS" to high school graduates, and "BA" to college graduates. C1 to C4 refers to consecutive cohorts, born between 1940-1949 (C1), 1950-1959 (C2), 1960-1969 (C3), and 1970-1979 (C4).

High school and college graduates worked the most, and approximately the same number of years over their lifetime (observed until age 47) in the 1950s cohort (25 out of 30 possible years, or 83% of the time). High school dropouts worked 3.3 years less over the same time period (22 out of 30 possible years, or 72% of the time). Dropouts in fact work less than more educated groups consistently in every age group, with the difference increasing over time. By the age group 53-57, dropouts work 58% of the time, vs 71% for high school and college graduates. While dropouts and high school graduates work most at the beginning of their life, and progressively less over time, college graduates reach the peak in the 28-32 age group, likely due to being in college and possibly further education before then.

Across cohorts 2, 3, and 4, we observe relative stability across for dropouts and high school graduates over time. College graduates, however, are working increasingly more across cohorts. By age 27, college graduates born in the 1950s worked on average 8.4 out of 10 possible years, while those born in the 1960s worked on average 8.6, and those born in the 1970s 9.1 years. This suggests that individuals increasingly work while in college. However, we can observe a similar trend also for later age groups when comparing cohorts 2 and 3: between ages 27 and 37 college graduates born in the 1950s worked 8.4 out of 10 years, while those born in the 1960s worked 0.4 years, or 4 percentage points more during the same ages.

Having analyzed the patterns of work over the lifetime with any earnings, Figure 3B now focuses on the cumulative number of years worked with significant earnings. It points to significant differences between education groups. High school graduates work jobs with

significant earnings for slightly more years than college graduates over the lifetime. Despite high school graduates working on average fewer years in each age group than college graduate after age 27, the latter never make up for the fact that high school graduates started working earlier. In the 1950s cohort, by age 47, high school graduates had earned significant incomes on average 21.3 out of 30 possible years, or 71% of years, whereas college graduates had done so for 20.5 years, or 68%. More striking is the difference between high school dropouts and high school graduates. For the same cohort, dropouts worked significant jobs only 16.1 out of 30 potential years by age 47, or 54%, and thus 5.3 years less than high school graduates. This discrepancy builds up throughout the lifetime. In the 1960s cohort, high school dropouts had worked significant jobs on average 1.0 year less than high school graduates by age 22, 2.1 years less by age 27, 3.2 years less by age 32, and 4.3 years less by age 37. While we observed already in Figure 3A that dropouts work fewer years with any earnings than those higher educated, this difference is much more pronounced when we focus on years with significant earnings. In the 1950s cohort, high school dropouts experience significant earnings only for ¾ of the years that high school graduates experience them. Out of 21.6 years worked by age 47, dropouts did not achieve significant earnings for an average of 5.6 years (26%). In contrast, out of 24.9 total years, high school graduates did not achieve significant earnings for only 3.6 years (14%).



Note: "Drp" refers to high school dropouts, "HS" to high school graduates, and "BA" to college graduates. C1 to C4 refers to consecutive cohorts, born between 1940-1949 (C1), 1950-1959 (C2), 1960-1969 (C3), and 1970-1979 (C4).

In Figure 3B, we observe relative stability across cohorts 2, 3, and 4, for all education groups over time starting with the age group 23-27. Individuals born in the 1970s worked jobs with significant earnings for approximately as much time in their mid-twenties to early thirties, as individuals with the same education level born in the 1950s. However, we do observe that individuals hold jobs with significant earnings increasingly less at the start of their careers, between ages 18-22. This effect is most pronounced for college graduates, who worked 1.7, or 34% out of 5 possible years between ages 18-22 in the 1950s cohort, which dropped to 0.9 years, or 18% for the 1970s cohort. This finding might represent that fewer college students work significant jobs on the side to finance their education. For high school dropouts the percentage of years with significant earnings between ages 18 and 22 dropped from 48% to 36% between the 1950s and 1970s cohorts. Given our definitions of the education groups, this effect is unlikely to be related to an increase in schooling. Rather, for high school graduates and dropouts, it points to the effect of weaker youth labor markets over time (Neumark (2002)).

We will now use the power of our unique panel data to unwrap the average differences in years worked over the lifetime between education groups. Do most high school dropouts work significantly less than high school graduates, or does the average difference stem from an extreme lower tail among dropouts that significantly lowers the average? Figures 4A and 4B help us answer this question by comparing histograms across education categories of the number of years worked during the first ten years of potential experience. We define potential

experience as beginning after entry into the labor market (first year with any earnings for Figure 4A, and first year with >$10,000 total annual earnings for Figure 4B).[23]

Figure 4A shows that a large and increasing majority of all men work for eight or more out of ten potential years (76% in the 1950s cohort to 84% in the 1970s cohort). College graduates experienced the largest increase in the fraction working eight or more years (72% to 86%), followed by high school graduates (78% to 83%). For dropouts, in contrast, this fraction deceased from 73% for the 1950s cohort to 67% for the 1960s cohort, and increased back to 72% for the 1970s cohort.

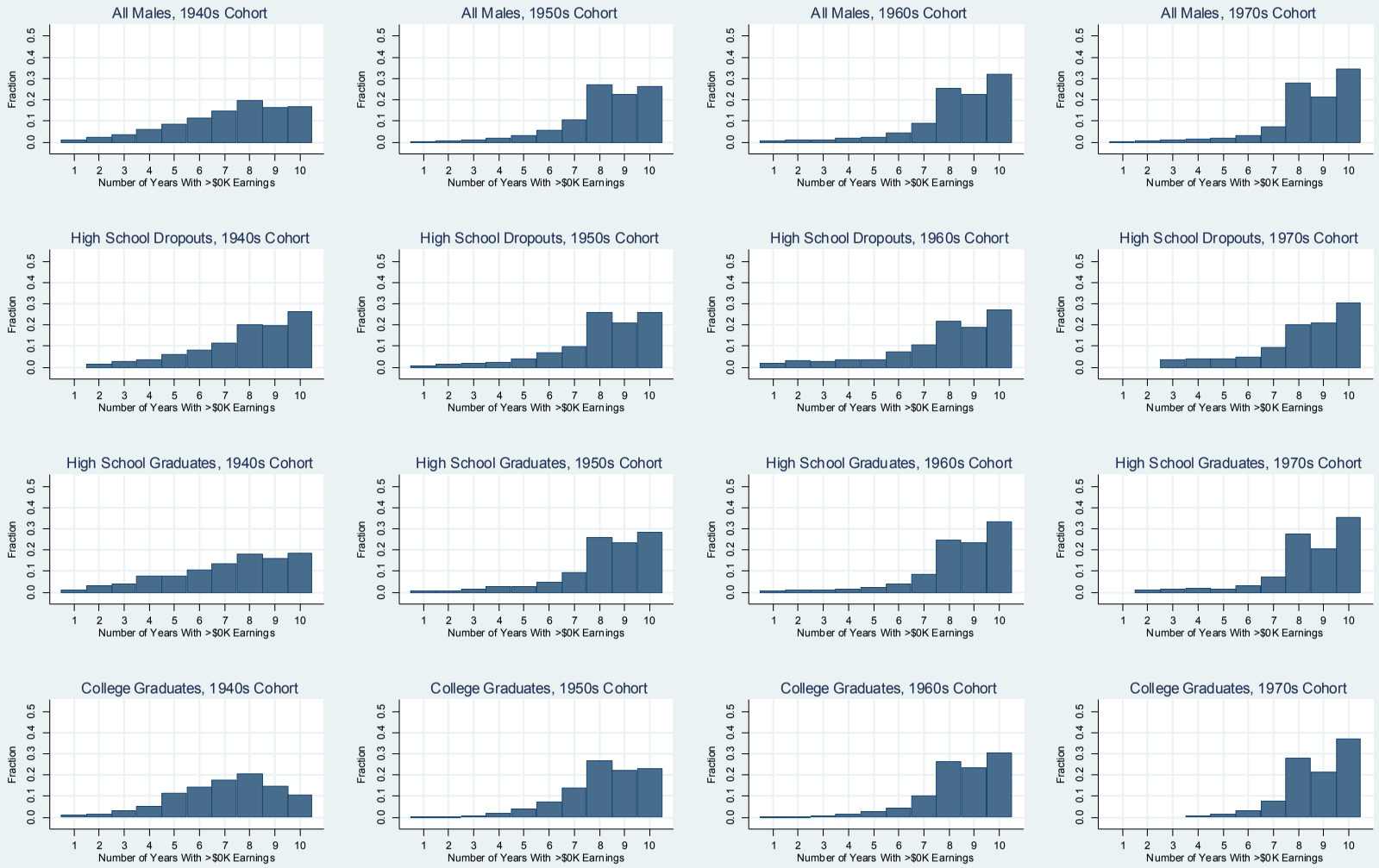
Comparing across education groups, in the oldest cohort, high school graduates are most attached to the labor market. However, college graduates become increasingly attached to the labor market in the beginning of their career. By the latest cohort the fraction working eight or more years thus increases by education.

The trend that individuals have become more attached to the labor market over time is mirrored when we focus on the fraction of individuals who work for the full ten potential years: we see a consistent increase across cohorts, from 26% to 35% for all males, and particularly large for college graduates (23% to 37%). By the most recent cohort more than a third of males work some job during all of their first ten years in the labor force.

[23] Topel and Ward (1992) found in their analysis of the 1939-1948 birth cohort that less than 1% of their sample of white males worked for four or fewer years during their first ten years of potential experience, and 85% worked for eight or more years. We should note that the authors used a quarterly definition of earnings, which means that if an individual worked a job with earnings close to the threshold of significant work for three out of four quarters in a year, Topel and Ward (1992) would count those three quarters, while we would not count the year as one with significant work. This data difference also means that in our study, the first ten years of potential labor market experience on average start later than in Topel and Ward's (1992) definition. We require a full year of significant earnings, rather than one quarter, which could be fulfilled by a summer job.

Figure 4A. Histograms of Actual Years Worked with Any Earnings by Cohorts and Education Groups

For Individuals with Ten Years of Potential Labor Market Experience



First ten years of potential labor market expereince defined as ten years starting with the first year of earnings greater than $0.

However, focusing on the left tail of the histograms that depicts those with the least labor market attachment paints a very different picture. Between the 1950s and 1960s cohorts, the fraction of all men that worked fewer than 4 out of 10 potential years increased from 2.4 to 2.6%. This was mainly driven by a stark increase in the fraction of high school dropouts who worked only 1-3 years out of 10. (from 4.4% to 7.8%). By the 1970s cohort, this fraction decreased slightly to 6.7%. Nevertheless, this fraction of least-working dropouts remained at more than twice the equivalent for high school graduates (2.8%), and more than 8 times that for college graduates (0.8%).

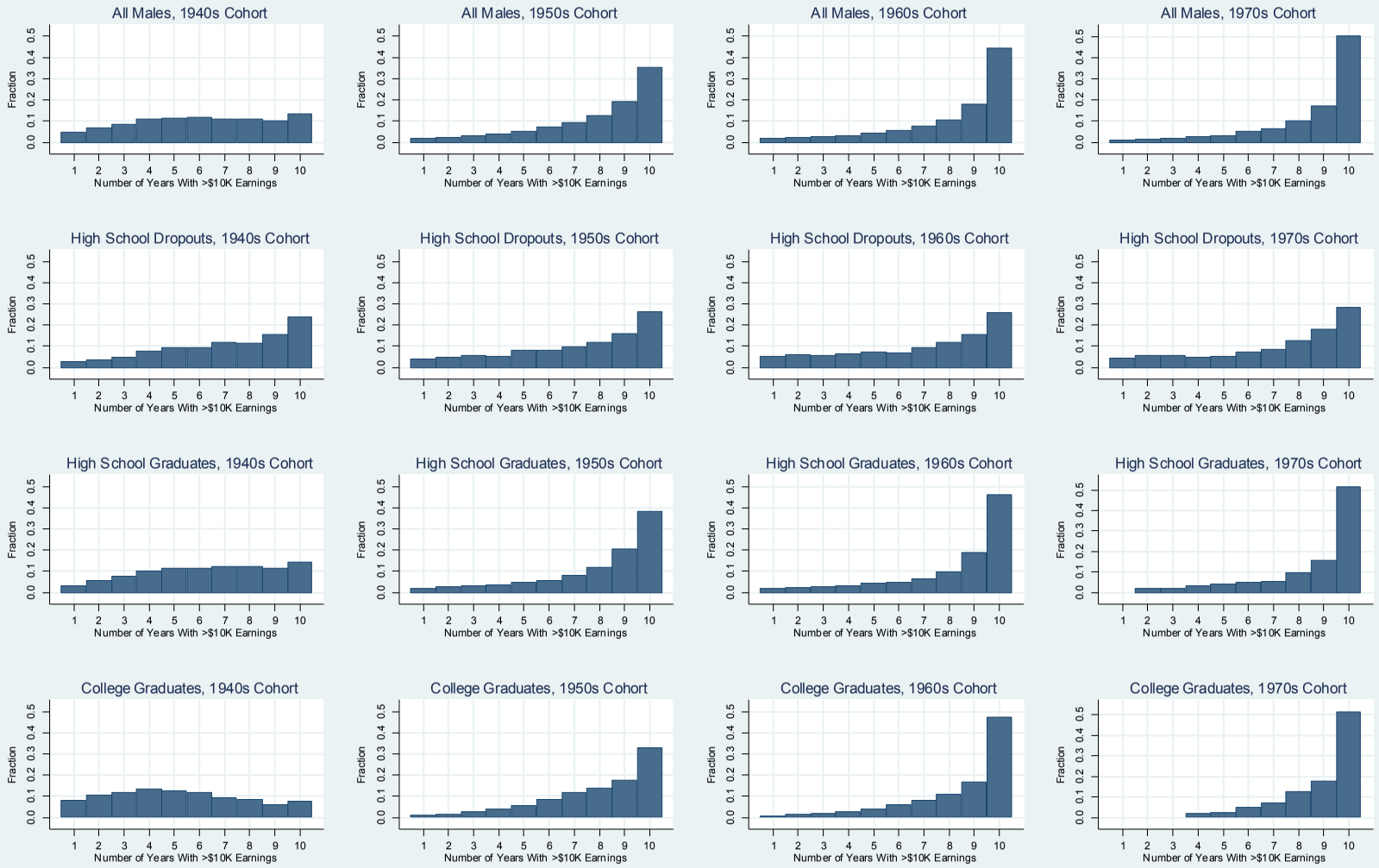
Taken together, the lower average number of years worked by dropouts during the 18-27 age group relative to better-educated groups (Figure 3A) is the result of a minority of dropouts starting to work later (Figure 1A), and who work for very few years during the beginning of their career (Figure 4A).

Figure 4B repeats the same analysis focusing only on years with significant earnings. We start counting ten potential years with the first year with significant earnings. We observe an increase in the fraction of all males who work significant jobs for the full ten potential years, from 35% in the 1950s cohort to 50% in the 1970s cohort. Concurrently, we observe a decrease in the fraction of individuals who had significant earnings for four or fewer years from 11% in the 1950s cohort to 8% in the 1970s cohort. The trends described for all males can be similarly observed for high school graduates and college graduates only. The histograms for high school dropouts, however, paint a very different picture. The fraction of dropouts working jobs with significant earnings for all of the first ten potential years increased between the 1950s and

1960s cohorts from 20% to 23%, and returned to 20% in the 1970s cohort. A fifth of high school dropouts thus worked significant jobs less than half of the first ten years. The fraction of dropouts who worked significant jobs the full ten years remained relatively stable, moving from 26% in the 1950s and 1960s cohorts to 29% in the 1970s cohort. This compares to a change for high school graduates from 38% in the 1950s cohort to 52% in the 1970s cohort. While more than half of the high school graduates work significant jobs for all of the first ten years of labor market experience in the most recent cohort, less than a third of dropouts do so, indicating a weak attachment to the labor force with significant years of non-employment after the onset of significant work. However, we should note that 59% of dropouts work significant jobs for at least eight out of ten years.

Figure 4B. Histograms of Actual Years Worked with Significant Earnings by Cohorts and Education Groups

For Individuals with Ten Years of Potential Labor Market Experience



First ten years of potential labor market expereince defined as ten years starting with the first year of earnings greater than $10,000.

2.4 Job Mobility Over the Lifetime

2.4.1 *Cumulative Number of Jobs over the Lifetime*

Topel and Ward (1992) demonstrated for their sample of individuals born between 1939 and 1948 that the average white male has held approximately seven jobs over the first ten years after entry into the labor force, and that the first full year of actual employment was on average divided among almost three jobs. In their analysis, an individual could hold a maximum of one job during a quarter, defined as the job, which provided the largest earnings in that quarter. Given our annual data, we cannot replicate Topel and Ward's (1992) quarterly methodology. Instead, for our analysis, individuals can hold a maximum of five jobs during a year[24]. For the analysis of cumulative jobs with significant earnings, we count any job associated with more than $10,000 in annual earnings, while for the analysis of cumulative number of any jobs, all jobs with positive earnings are counted[25]. For this analysis, we require employer-employee records, which are only available in the DER, starting in 1978.

Figure 5A illustrates the cumulative number of jobs with significant earnings by age for different education categories and cohorts. Unfortunately, we do not observe earnings by employer at early ages for the older cohorts. Therefore, we set the number of cumulative jobs for the first age for which data are not available equal to the equivalent number of jobs calculated for the closest cohort, for which data are available. The figure shows that on average college graduates hold approximately 1.9 jobs by 28, 3.6 jobs by 38, 4.9 jobs by 48, and 5.9 jobs by age 58. High

[24] The percentage of individuals with more than five jobs during a year is very small in all years.

[25] If an individual has earnings from a firm in year x, no earnings from the same firm in year x+1, and resumes earnings in any year greater than x+1, the second employment spell is counted as an additional new job.

school graduates accumulate slightly fewer jobs relative to college graduates by age 58 (5.1 jobs). However, due to earlier onset of work, this relationship is reversed for the initial years of work life. High school graduates have a greater number of jobs through age 28. High school dropouts hold significantly fewer jobs with significant earnings at all ages, accumulating only 4.1 jobs on average by age 58. Figure 5A also shows that the number of jobs with significant earnings decreased between the 1960s and 1970s birth cohorts for college and high school graduates. By age 28, college (high school) graduates in the 1960s cohort had held an average of 1.9 (1.9) jobs, which decreased to 1.8 (1.6) for the 1970s birth cohort. This is consistent with our results from Figure 3B that showed a decrease by 0.2 (0.3) years for college (high school) graduates in the number of cumulative years worked with significant earnings by age 28. A lower number of cumulative jobs thus does not imply more long-term employment relationships, but rather more years without significant earnings. Dropouts, in contrast, have a flat trend in terms of average number of jobs across cohorts. For this group, we had found an increase in the number of cumulative years with significant earnings by age 28 (from 4.2 to 4.6).

Topel and Ward (1992) estimated that young white males held on average 7 full-time jobs during their first 10 years in the labor market. We show that among individuals born in the 1960s and 1970s, the average college graduates holds approximately 1.8 to 2.0 jobs with significant earnings between age 18 and 28, while a high school graduate hold 1.6 to 1.9 jobs, a GED recipient 1.8 jobs, and a high school dropout 1.4 to 1.6 jobs. However, these numbers are not directly comparable to Topel and Ward (1992), as they use a quarterly definition of full-time job, while we define significant jobs at an annual level.

Figure 5A: Cumulative Number of Jobs with Significant Earnings Over the Lifetime:
College Graduates, High School Graduates, and High School Dropouts

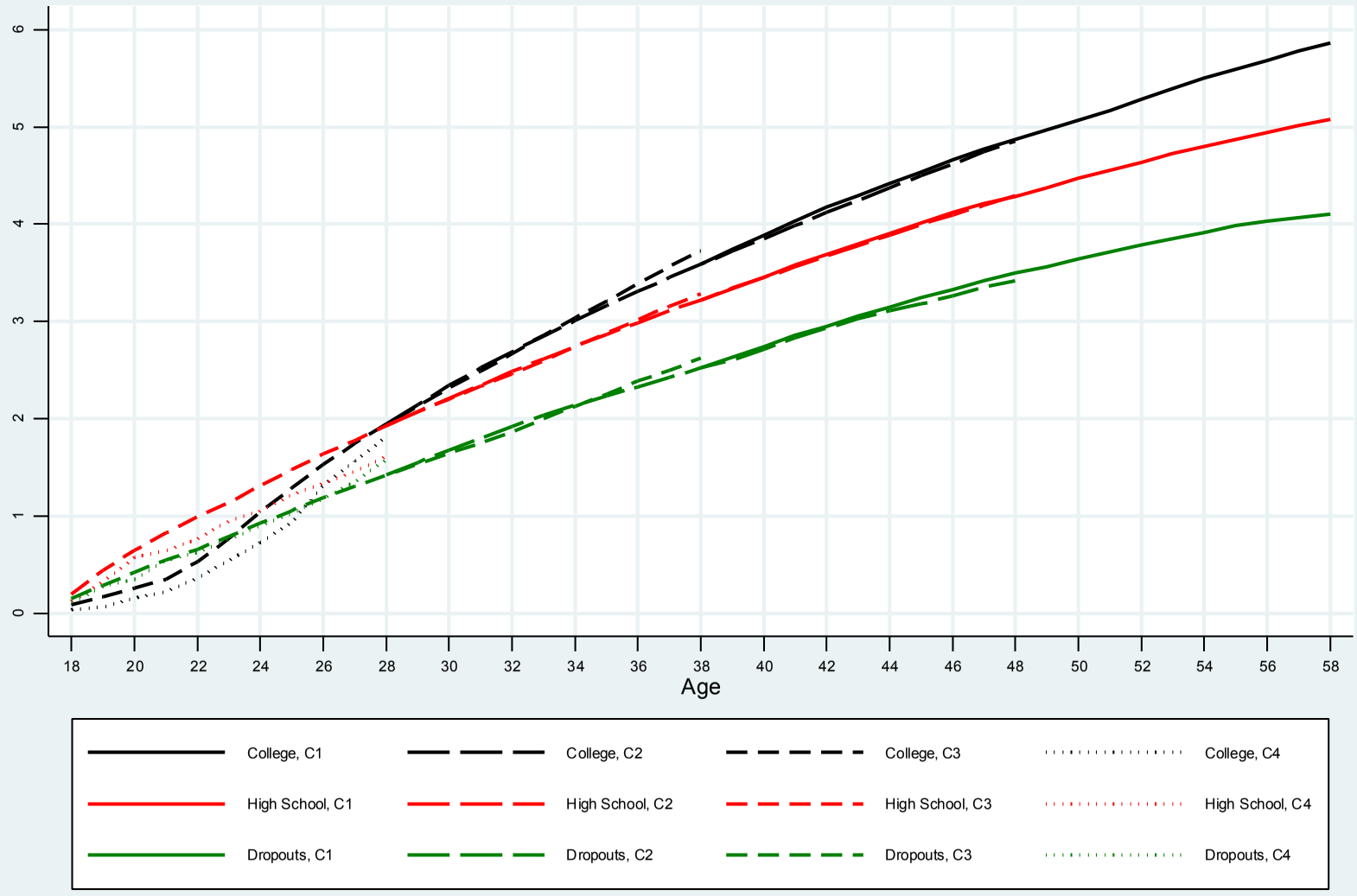


Figure 5B also renders the number of cumulative jobs with significant earnings over time, focusing only on lower-educated groups, including dropouts, GED recipients, and high school graduates. We show that GED recipients are very similar to high school graduates, and in fact achieve a higher number of significant jobs by age 38 than high school graduates. High school dropouts are clearly on a separate trajectory from both high school graduates and GED recipients with significantly fewer cumulative significant jobs at all ages.

While figures 5A and 5B illustrated that higher educated individuals hold more significant jobs, Figure 5C, which considers jobs at any level of earnings, shows that lower-educated groups on average hold a higher number of overall jobs, but more of those jobs result in less than $10,000 annual earnings. Despite working fewer years on average, as seen in Figures 4A and 4B, high school dropouts accumulate the highest number of jobs, 19.3, by age 58 (compared to 17.7 and 16.0 for high school and college graduates, respectively). While dropouts track college and high school graduates relatively closely at early ages in terms of number of jobs, the curves become flatter by age 28 in the 1960s cohort for the more educated groups, but remain steep for dropouts. The age at which education groups diverge decreased over time: in the 1970s cohort, the curves have already separated at age 24. All education groups, but in particular those less educated, hold more jobs at any given age in more recent cohorts, with a particularly striking increase between the 1960s and 1970s cohorts. High school graduates (dropouts) at age 28, for example, used to have accumulated an average of 8.6 (9.0) jobs in the 1960s cohort, compared to 10.3 (11.5) jobs in the 1970s cohort. This represents a 20% (28%) increase.

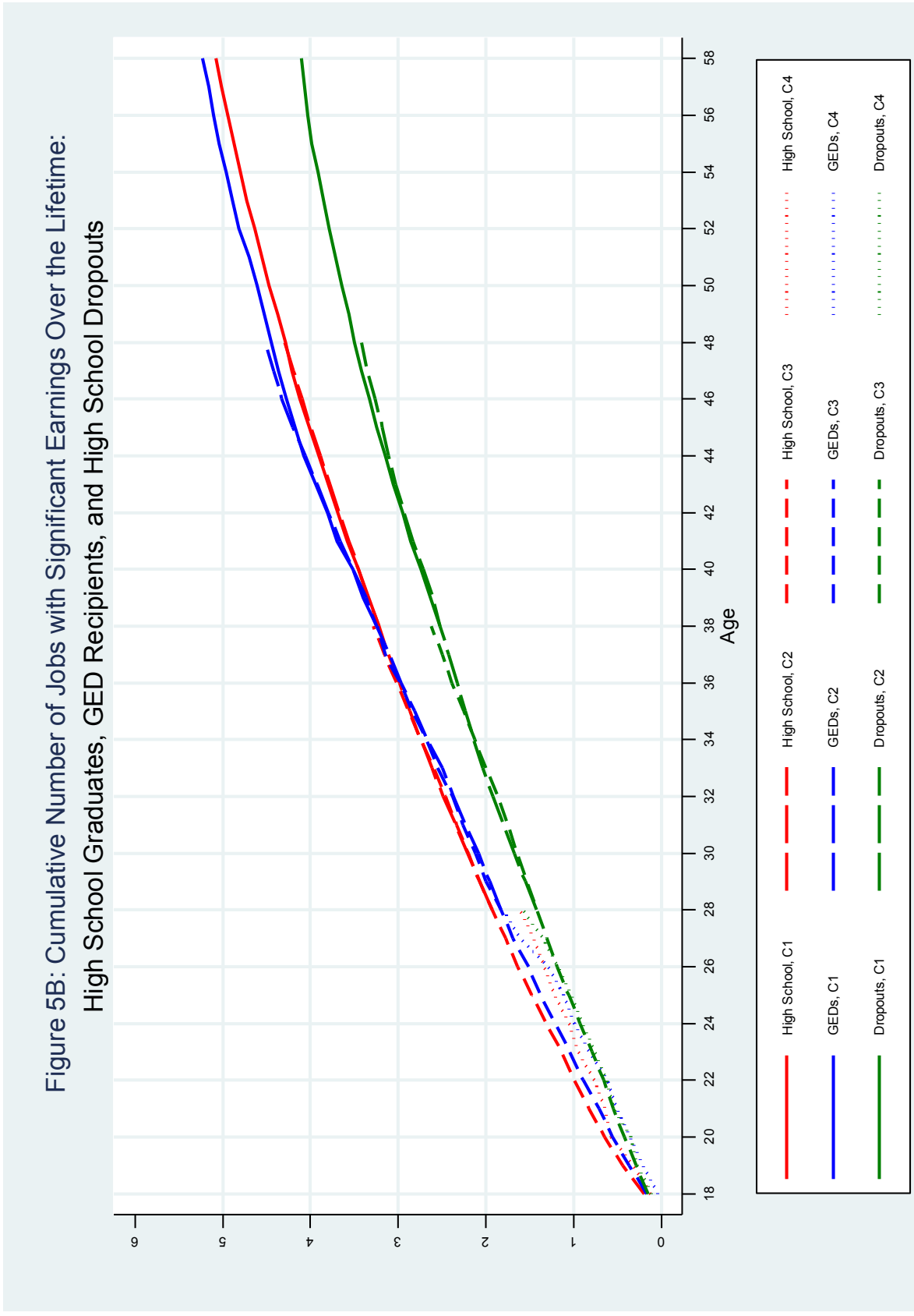


Figure 5B: Cumulative Number of Jobs with Significant Earnings Over the Lifetime:
High School Graduates, GED Recipients, and High School Dropouts
0
1
2
3
4
5
6
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
Age
High School, C1
GEDs, C1
Dropouts, C1
High School, C2
GEDs, C2
Dropouts, C2
High School, C3
GEDs, C3
Dropouts, C3
High School, C4
GEDs, C4
Dropouts, C4

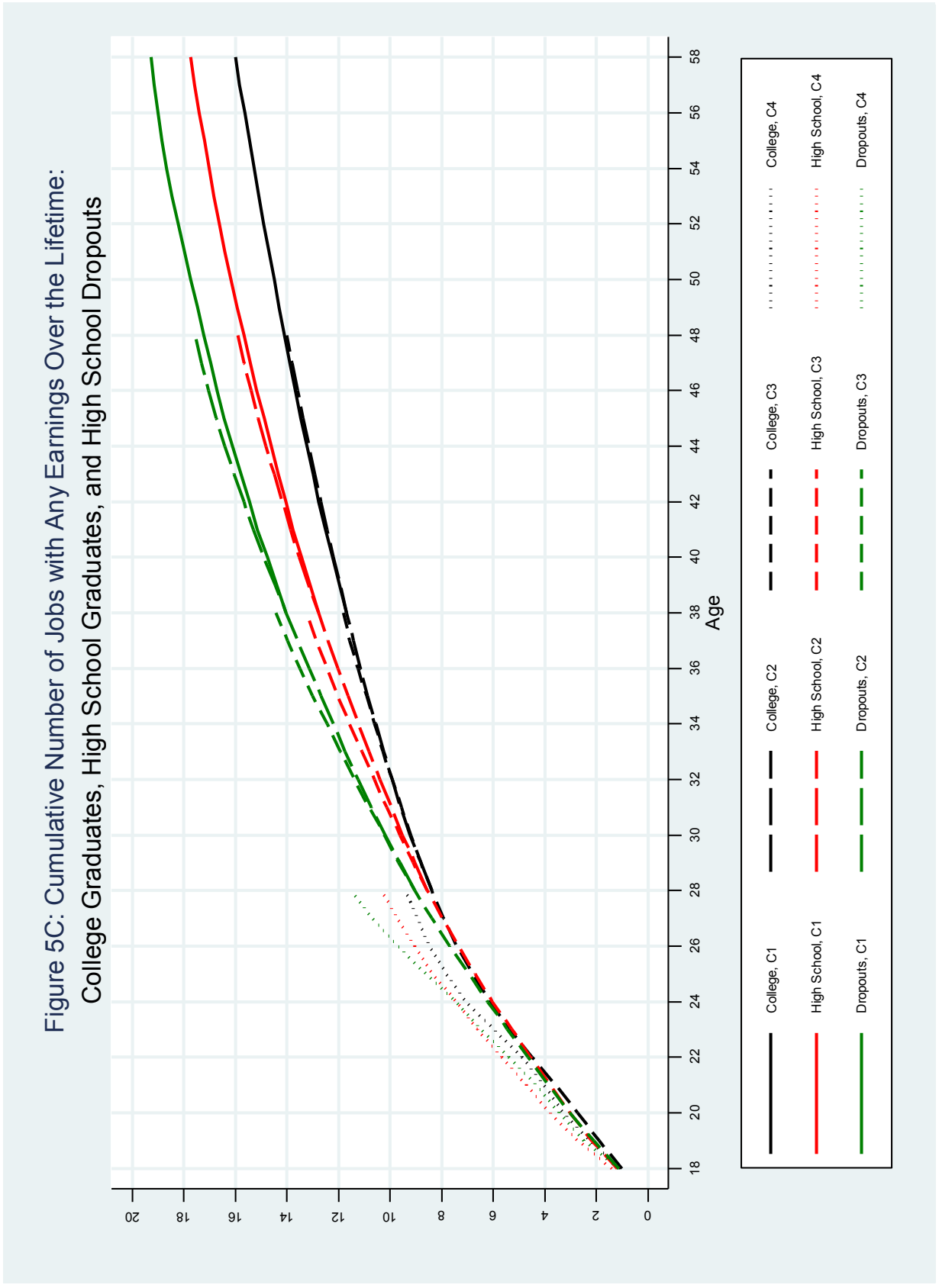


Figure 5C: Cumulative Number of Jobs with Any Earnings Over the Lifetime:
College Graduates, High School Graduates, and High School Dropouts
0
2
4
6
8
10
12
14
16
18
20
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
Age
College, C1
College, C2
College, C3
College, C4
High School, C1
High School, C2
High School, C3
High School, C4
Dropouts, C1
Dropouts, C2
Dropouts, C3
Dropouts, C4

Figure 5D: Cumulative Number of Jobs with Any Earnings Over the Lifetime:
High School Graduates, GED Recipients, and High School Dropouts

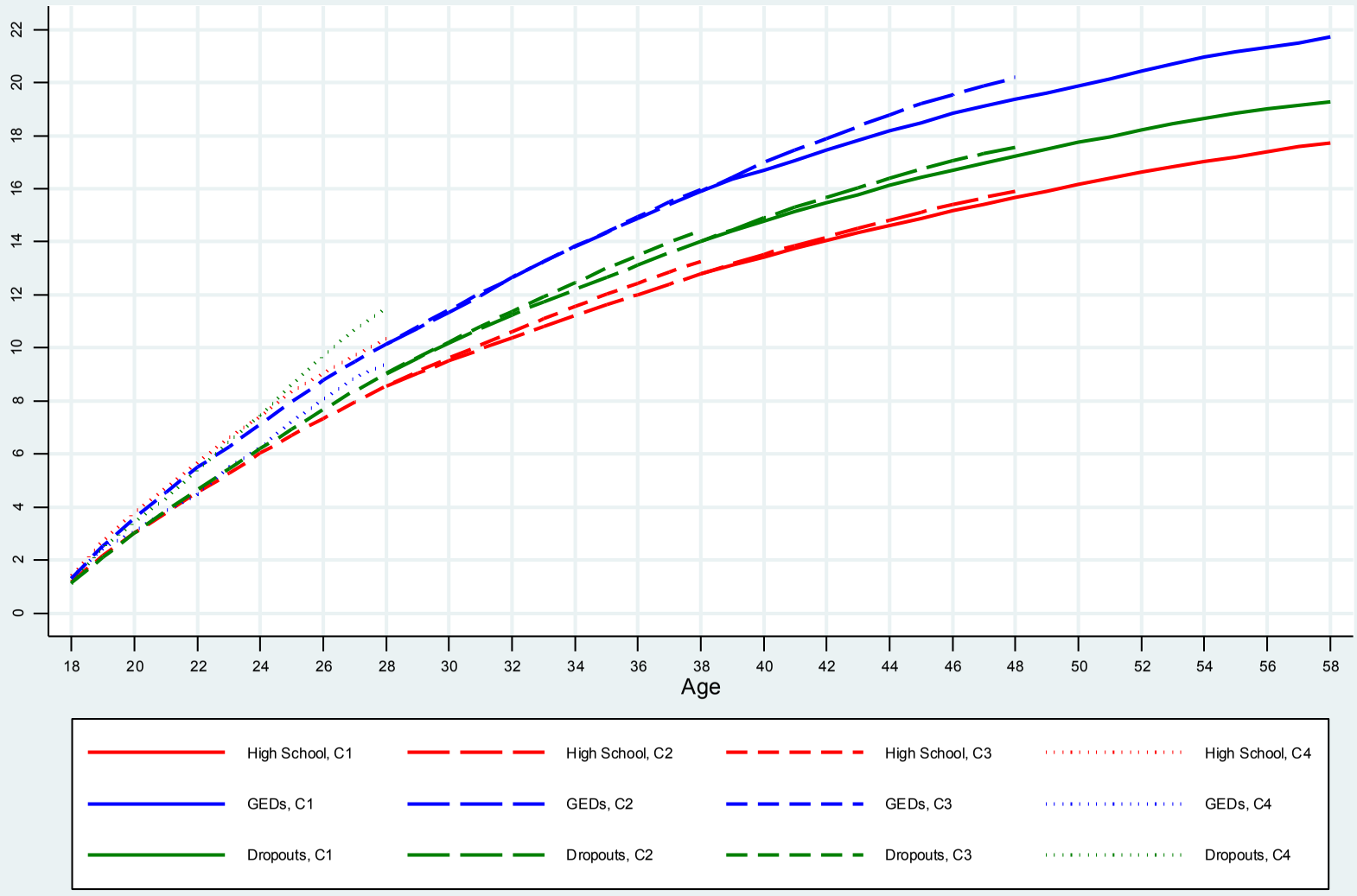


Figure 5D also considers jobs with any positive earnings, but focuses only on the less-educated groups. It shows that GED recipients have the highest cumulative number of jobs at all ages in the 1940s, 1950s, and 1960s birth cohorts, relative to high school graduates and dropouts. By age 58, GED recipients have accumulated an average of 21.7 jobs, as compared to 17.7 for high school graduates, and 19.3 for dropouts. This ranking has reversed in the most recent 1970s birth cohort: Here GED recipients held the fewest number of jobs by age 28 (9.4), as compared to 10.3 for high school graduates, and 11.5 for high school dropouts.

Figures 6A and 6B consider the distributions of the cumulative number of jobs after ten years of potential experience for different cohorts and education groups. We consider only the 1960s cohort, as we observe those individuals from the beginning of the potential work life starting at age 18, and until at least age 38. As in Figures 5A and 5B, we define potential experience as beginning after entry into the labor market (first year with >$10,000 earnings for Figure 6A, and first year with any earnings for Figure 6B). In Figure 6A, we only report the fraction of individuals who held up to 6 jobs during the first ten years due to disclosure reasons, and only up to 5 jobs for high school dropouts in the 1970s cohort[26]. In all education groups, the majority of individuals held only one or two jobs with significant earnings during the first ten potential years. The fraction of people with one or two jobs was lower for those with higher education levels (in the 1960s cohort, it was 67% for high school dropouts, 63% for high school graduates, and 54% for college graduates). In the more recent 1970s cohort, the fraction with one or two

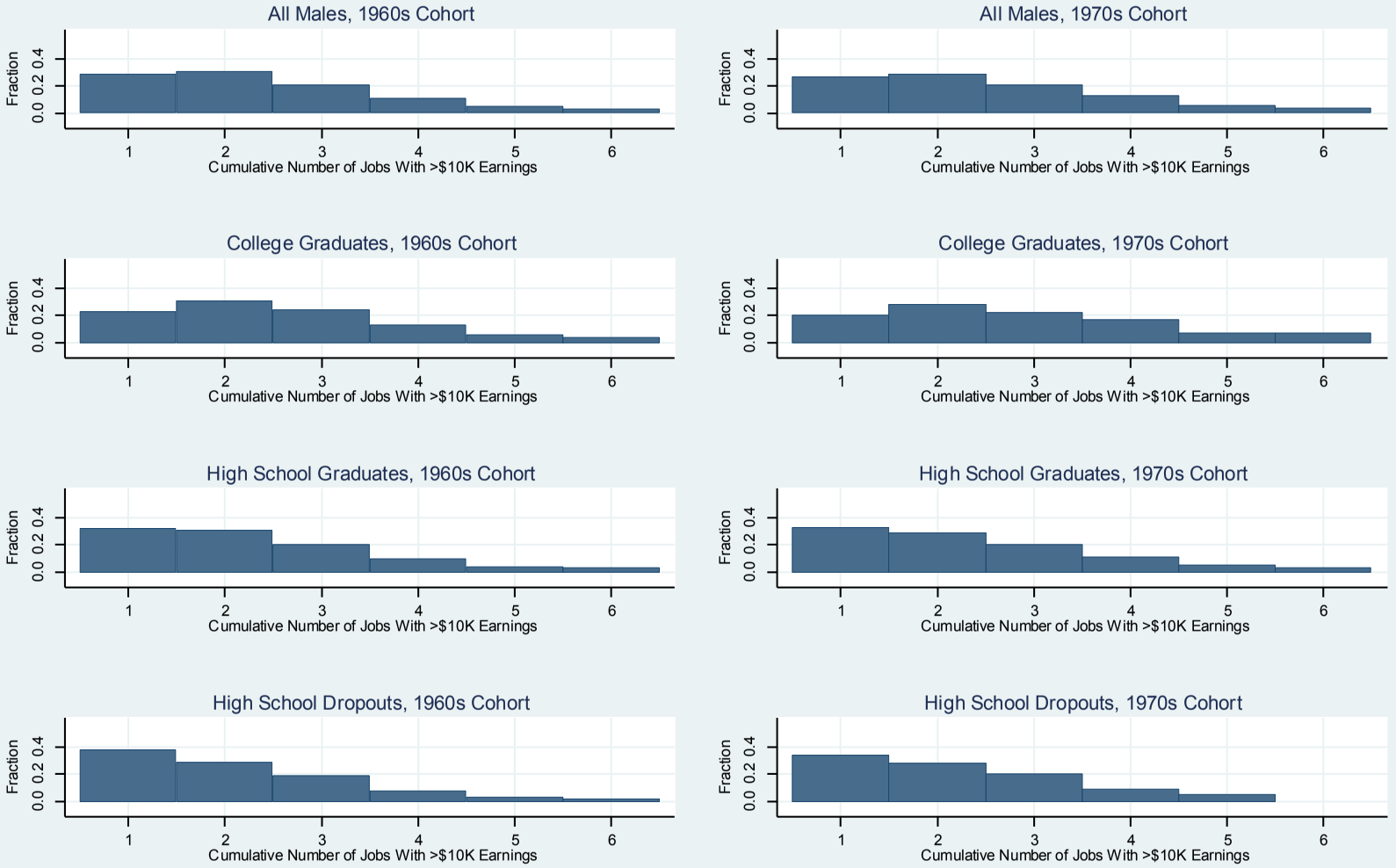
[26] We cannot disclose the fraction of individuals that held higher number of jobs as it would be based on too few individual observations. For each education group and cohort, this excludes less than 1% of the full distribution with the exception of high school dropouts in the 1970s cohort, where we exclude 4% of the distribution on the relevant histogram.

jobs decreased relative to the 1960s cohort by 4 percentage points for all males, and most for college graduates (6 percentage points) and high school graduates (5 percentage points). Concurrently, the fraction with more than 4 jobs increased significantly for all groups (from 8% to 10% for all males). While the majority of workers continue to hold relatively few significant jobs during the first ten years, an increasing fraction is changing significant jobs frequently.

Figure 6B focuses on the distribution of the number of jobs with any earnings during the first ten potential years. For disclosure reasons, we do not present the fraction of high school dropouts with only one job for the 1970s cohort. In contrast to the histograms in Figure 6A on number of significant jobs, which were bunched around lower numbers of jobs, the histograms in Figure 6B are much flatter, with more of the distribution spread to higher numbers of jobs. Especially high school dropouts are a very heterogeneous group in terms of number of jobs held. While we saw in Figure 5C that high school dropouts hold the highest number of jobs on average at any age, a higher fraction of this group (29%) held only three or fewer jobs during the first ten potential years, compared to 28% for high school graduates, and 16% for college graduates. College graduates are relatively more bunched at higher numbers of jobs (in the 1960s cohort, 31% held eight or more jobs, relative to 28% of high school dropouts, and 25% of high school graduates). As they start working later, the average number of cumulative jobs at a given age nevertheless remains lower relative to less-educated groups.

Figure 6A. Histograms of Cumulative Number of Jobs with Significant Earnings

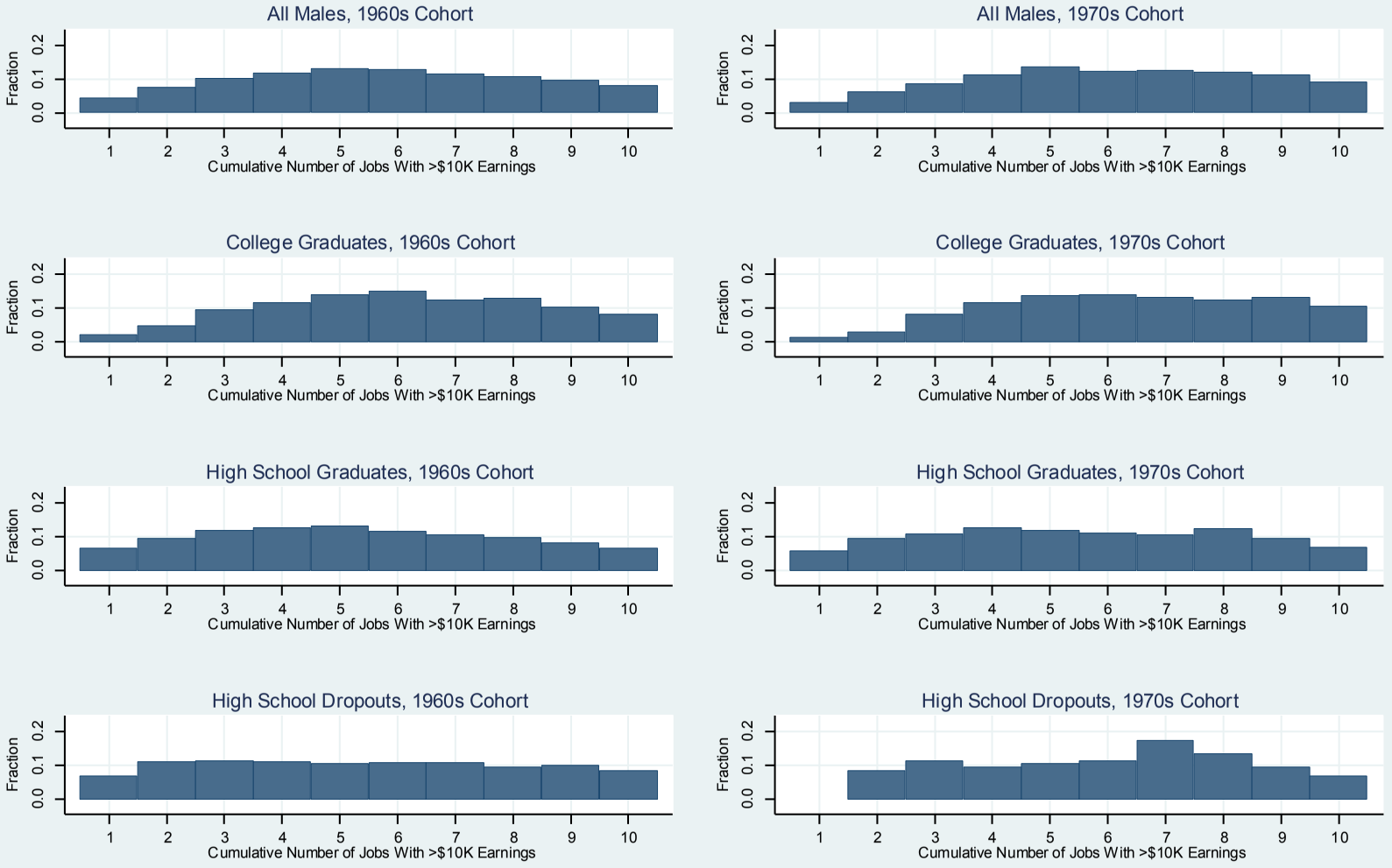
For Individuals with Ten Years of Potential Labor Market Experience



First ten years of potential labor market experience defined as ten years starting with the first year of earnings greater than $10K.

Figure 6B. Histograms of Cumulative Number of Jobs with Any Earnings

For Individuals with Ten Years of Potential Labor Market Experience



First ten years of potential labor market experience defined as ten years starting with the first year of earnings greater than $0K.

Across cohorts, we observe an increase in the fraction of individuals holding a higher number of jobs. While 29% of all males in the 1960s cohort held eight or more jobs during the first ten potential years, the fraction increased to 32% for the 1970s cohort. This trend holds true for all education groups.

2.4.2 *Tenure*

There is evidence that long-term employment relationships have become less common in the United States over the last two decades. Most recently, Farber (2010) analyzed tenure patterns in the U.S. between 1973 and 2008, using data from the Current Population Survey. He found that mean job tenure has decreased significantly during that period in the private sector, but has simultaneously risen in the public sector. In our analysis, we will consider only the private sector, as our sample sizes are not sufficient for a separate analysis of the public sector. Decreased average tenure, or higher job exit rates, could explain our above finding that across all education groups, individuals hold a higher number of cumulative jobs (at least when considering jobs with any earnings, rather than just focusing on jobs with significant income). We will therefore first analyze job tenure patterns in this section, and then focus on job exit hazard rates.

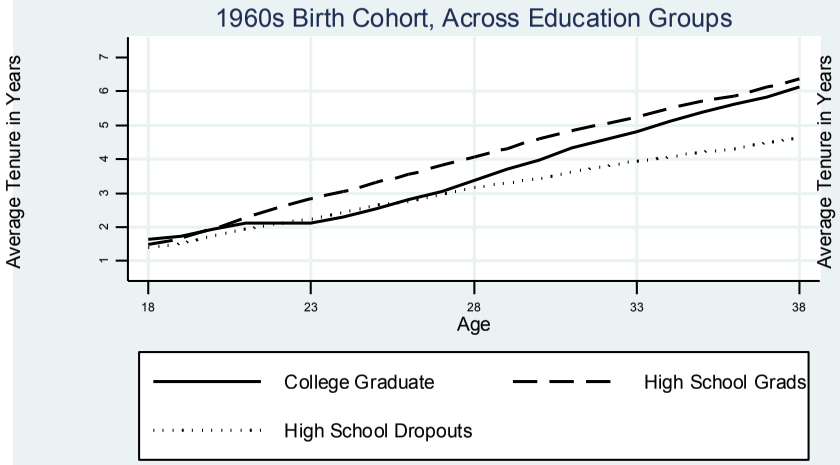
We define tenure as the number of continuous years that an individual has received any earnings from his main employer in a particular year[27]. Given that this analysis requires

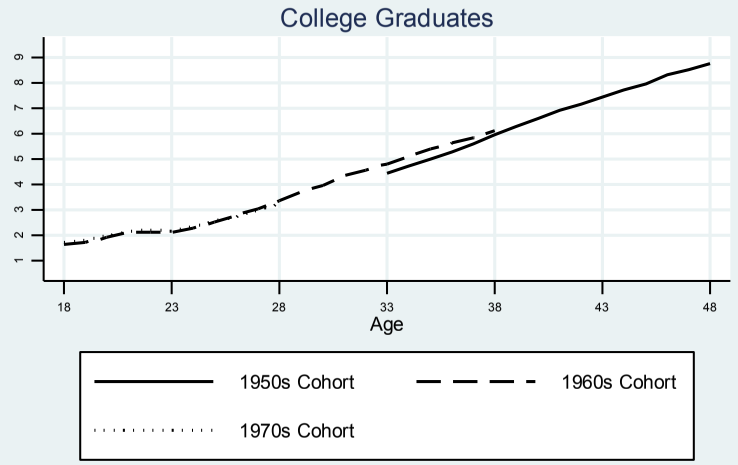
[27] Main employer is defined as the employer associated with the highest earnings in a particular year. For the calculation of tenure years, we also count years in which that employer did not provide the

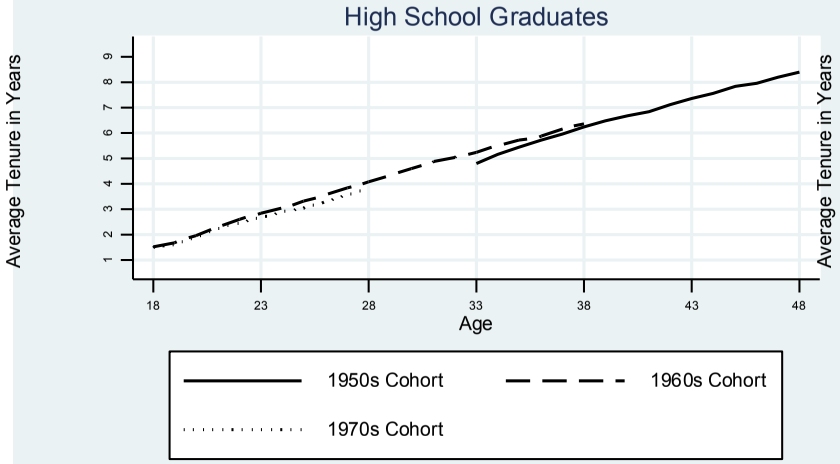
employer-employee data, we can only conduct it for 1978 onward with the DER data. In Figure 7A, we demonstrate differences in average tenure both across education groups, as well as across cohorts. Average tenure increases with age for all education groups from 1.4-1.6 years at age 18 (depending on education group) to 4.6-6.4 years by age 38, and 6.9-8.8 years by age 48. Tenure for high school graduates is consistently higher than for other education categories, for all ages that we observe in the 1960s cohort (18-38). However, in the 1970s cohort, college graduates have caught up with high school graduates by age 41 in terms of average tenure, and outrank the less-educated groups thereafter. High school dropouts start out with lower average tenure in their teenage years, and the wedge between this group and high school graduates is increasing over the lifetime. By age 38, high school dropouts have on average 1.8 years lower tenure than high school graduates. While average tenure increases linearly by between 0.15 to 0.18 years (0.23 to 0.26 years) per year of age for high school dropouts (high school graduates), for college graduates it remains relatively low at 0.10 years per year of age until age 23, and then increases with a steeper slope of around 0.28 years per year of age after college graduation. Between the 1950s and 1960s birth cohorts, average tenure has increased for the ages that we observe in both cohorts (33 to 38) by 0.1 - 0.4 years. Between the 1960s and 1970s cohorts, however, this trend was reversed for ages 18-28, with lower average tenure for the most recent cohort, particularly for high school dropouts.

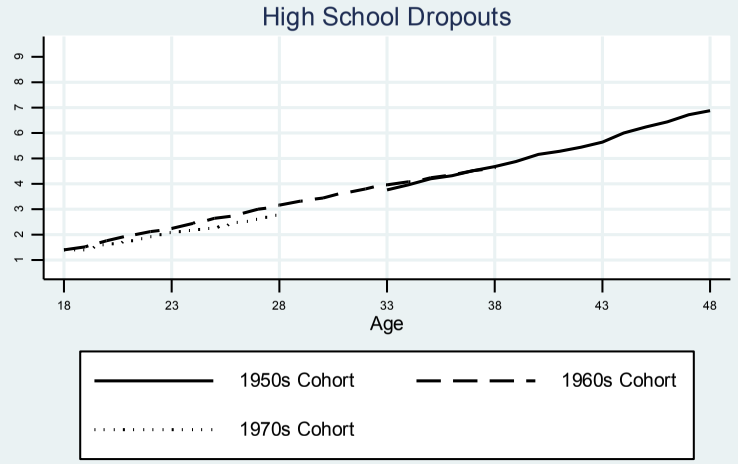
highest earnings. Note that tenure according to our definition does not equal completed job durations, as many jobs with be in progress in a year for which tenure is calculated.

Figure 7A. Average Tenure by Age and Education Across Cohorts: Private Sector









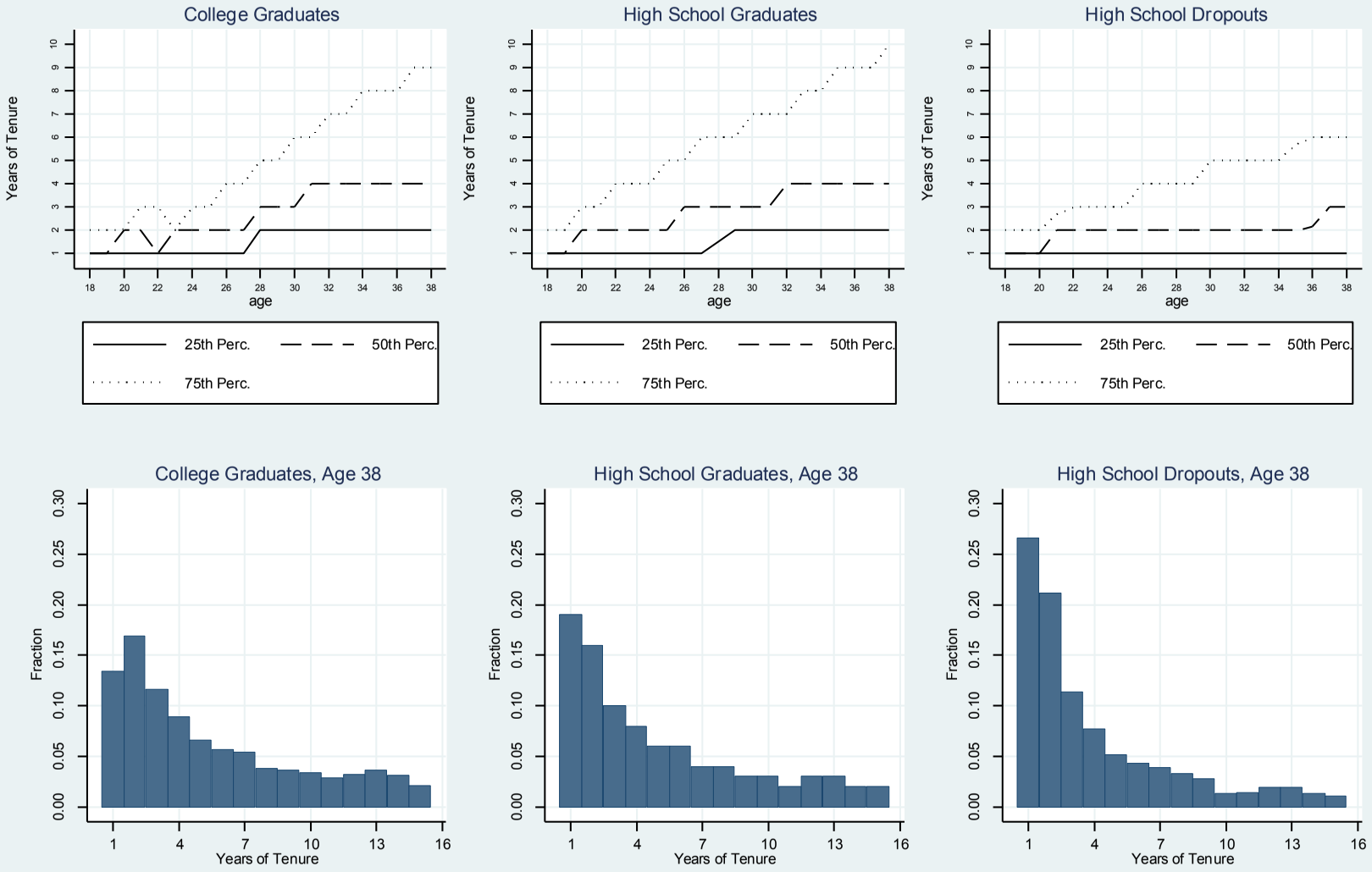
Cohort definitions: 1950s = 1950-1959, 1960s = 1960-1969, 1970s = 1970-1975.
Earnings data by employer available from DER for 1978-2007.

Figure 7B unwraps the averages shown in Figure 7A, and illustrates the distributions of tenure by age for different education groups in the 1960s cohort. As above, these results are restricted to the private sector. The top row of graphs shows the 25th, 50th, and 75th percentiles of years of tenure by education for ages 18-38. The bottom row focuses on individuals aged 38, and illustrates the full distribution of years of tenure.[28] The 25th percentile and median tenure for college graduates and high school graduates are very similar (approximately 1 and 2 years, respectively, in the 20s, and 2 and 4 years, respectively, in the 30s). Median tenure increases slightly earlier, at age 26, for high school graduates, relative to age 28 for college graduates. However, the 75th percentile is consistently higher for high school graduates, who started working earlier on average. The picture for high school dropouts looks dramatically different. Throughout the entire age range from 18 to 38, the 25th percentile of tenure remains at the minimum 1 year, and median tenure remains at 2 years until age 36. The 75th percentile increases to 6 years by age 36, compared to 9 years for college graduates, and 10 for high school graduates. The bottom part of Figure 7B confirms these findings. The distributions of years of tenure at age 38 are relatively similar for college graduates and high school graduates, while the distribution for dropouts is skewed to the left: 48% of dropouts have 1 or 2 years of tenure, relative to 35% of high school graduates, and 30% of college graduates. The lower average tenure at all ages for high school dropouts seen in Figure 7A stems from the fact that the entire distribution of years of tenure is skewed to the left for this group relative to more educated groups. Farber (2010) found that for 30-39 year olds, 17% in the private sector have a tenure of less than one year. Our histograms in the bottom panel of Figure 7B show that this

[28] For the definition of tenure, we also consider years worked prior to age 18 in a job that is still held at age 18.

figure masks significant heterogeneity by education groups: 13% of college graduates have less than 1 year of tenure at age 38, compared to 19% of high school graduates, and 27% of dropouts.

Figure 7B. Distribution of Tenure by Age and Education: Private Sector, 1960s Cohort



Earnings data by employer available from DER for 1978-2007.

2.4.3 Job Exit Hazard

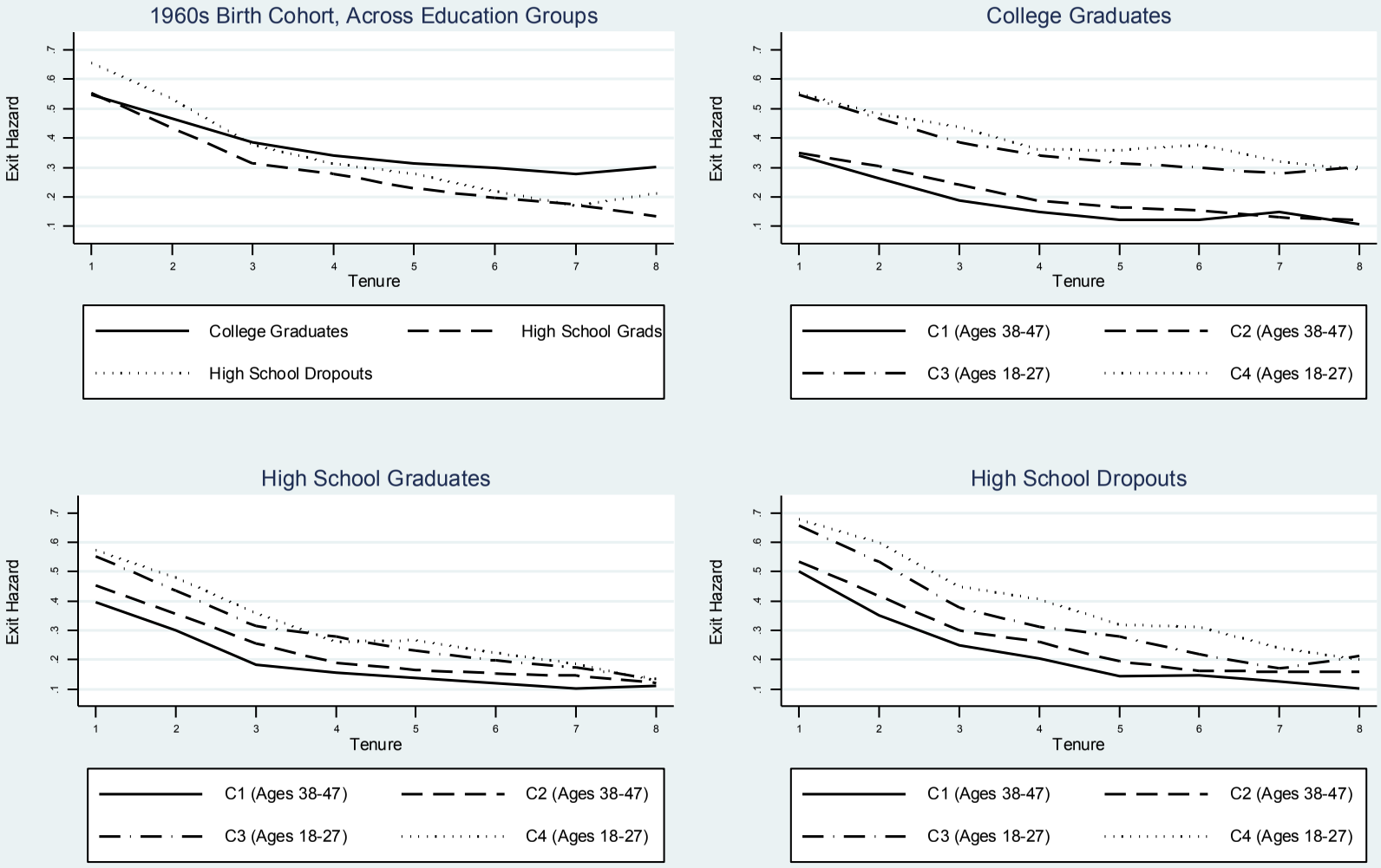
We define job exit hazard rates as the probability that an individual's main employer in year i ceases to be his employer in the year i+1. This can either be due to a switch to another employer, or due to moving into a period of non-employment. We do not have data on whether a separation was voluntary or due to a layoff. We analyze job exit hazard rates both by years of tenure, and by age. As in the previous section, we limit our analysis to private sector employment.

Figure 8A illustrates average job exit hazards by tenure both across education groups and cohorts for private sector employees. The first graph shows average exit hazards for college graduates, high school graduates, and high school dropouts in the 1960s cohort. The remaining graphs show differences across cohorts for each of the education groups. In order to make cohorts comparable, we show the results only for overlapping ages: ages 38-47 for the 1940s and 1950s cohorts, and ages 18-27 for the 1960s and 1970s cohorts. As expected, job exit hazards are decreasing by tenure for all education groups. As the first graph illustrates though, the exit hazard – tenure profile is flatter for college graduates, who have lower exit hazards at low tenure years, and higher exit hazards at higher tenure years. In the first year of tenure, college graduates and high school graduates have a 55% likelihood of changing employer or moving to non-employment, compared to 66% for high school dropouts in the 1960s cohort. In contrast, in the eighth year of tenure, college graduates have an exit hazard of 30%, compared to 14% for high school graduates, and 21% for high school dropouts. We saw in the previous section that a lower fraction of less educated groups reach higher years of tenure relative to

college graduates. Figure 8A illustrates that those high school graduates or dropouts who do reach those higher years are more likely than college graduates to remain with the same employer going forward. However, for high school dropouts, the majority remains in the 1-2 year tenure range, where they have a relatively higher exit hazard.

The remaining three graphs on Figure 8A show that there is a continuous increase in exit hazard rates across cohorts. The increase is more pronounced for those less educated. For example, while exit hazards at two years of tenure barely increased for college graduates between the 1960s and 1970s cohorts (from 47% to 48%), they increased from 44% to 48% for high school graduates, and from 53% to 60% for dropouts. This also implies that high school graduates and college graduates have become more similar in terms of exit hazard rates, while the gap with high school dropouts has widened.

Figure 8A: Job Exit Hazards by Years of Current Tenure: Private Sector



Earnings data by employer available from DER for 1978-2007.
Cohort definitions: C1 = birthyears 1940-1945, C2 = 1950-1955, C3 = 1960-1965, C4 = 1970-1975.

When we compare our results on exit hazard rates by tenure with those of Topel and Ward (1992), the importance of differences across education categories, the length of time individuals are observed, and changes across cohorts becomes clear. Topel and Ward (1992) find that two out of three jobs end during the first year of tenure in their sample. We show that in the cohort Topel and Ward analyzed, high school dropouts had an exit hazard rate in the first year that was almost 50% higher than the equivalent for college graduates. Topel and Ward's (1992) average therefore masks significant heterogeneity by education[29]. Topel and Ward (1992) also find that exit hazard rates taper out around 20% on an annual basis after five years of tenure. We observe individuals over a longer time period, and show instead that exit hazard rates continue to decline even beyond five years of tenure, for all education groups, and in all cohorts. In the cohort closest to the one analyzed by Topel and Ward (1992), exit hazard rates after eight years of tenure are in fact 11% lower than exit hazard rates after five years of tenure for college graduates (21% lower for high school graduates, and 29% lower for high school dropouts). Moreover, while exit hazard levels cannot be directly compared between this paper and Topel and Ward (1992), due to the difference in quarterly and annual definitions of exit hazard rates, our analysis shows that exit hazards have increased substantially since the cohort that Topel and Ward (1992) analyzed for all education categories.

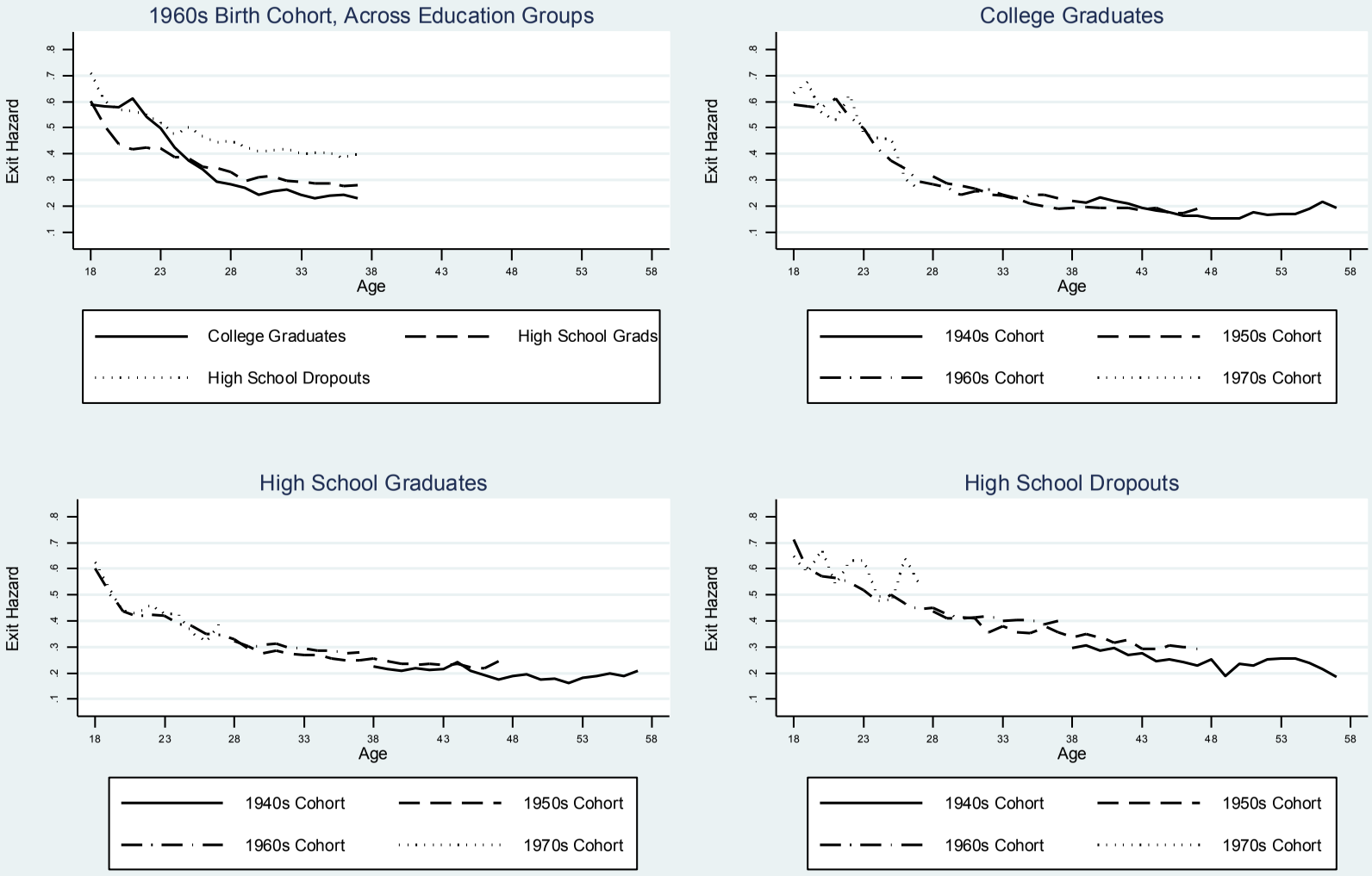
Figures 8B describes the relationship between age and job exit hazard rates both across education groups and cohorts. Following the structure of Figure 8A, the first graph compares

[29] The levels of our estimated exit hazards are lower than Topel and Ward's. This is likely due to the fact that we conduct an annual analysis, and only consider the hazard rate for an individual's main job during a particular year, whereas Topel and Ward (1992) calculate quarterly hazard rates, and therefore capture hazards from jobs that did not provide an individual's main earnings on an annual basis.

education groups for the 1960s cohort only, while the remaining graphs illustrate changes over time by education group. The first graph shows that exit hazards are decreasing with age, and higher for high school dropouts than high school graduates at all ages between 18-38. Exit hazards for college graduates are initially relatively high, reaching their peak at age 21 with 61%, and only thereafter start to decrease, albeit at higher rate than high school graduates and dropouts. By age 25, exit hazards for college graduates are below those for high school graduates. After a relatively steep initial decrease in job exit hazards for all education groups from age 18 to approximately 28, exit hazards are relatively flat, though still slightly decreasing, between ages 28 and 37. At age 37, 23% of college graduates change jobs or move into non-employment, compared to 28% for high school graduates, and 40% of dropouts.

The remaining graphs in Figure 8B illustrate changes in job exit hazards across cohorts for each education group. For all overlapping years, we observe an increase in hazard rates across cohorts, which is larger for the less educated groups. For example, between the 1940s and 1950s cohorts, the exit hazard at age 47 increased from 16% to 19% for college graduates, from 17% to 24% for high school graduates, and from 23% to 29% for dropouts. We also illustrate that high school dropouts continue to have relatively higher job exit hazards until the end of their careers: at age 55, the hazard for dropouts is 24%, compared to 20% for high school graduates, and 19% for college graduates.

Figure 8B: Job Exit Hazards by Age: Private Sector



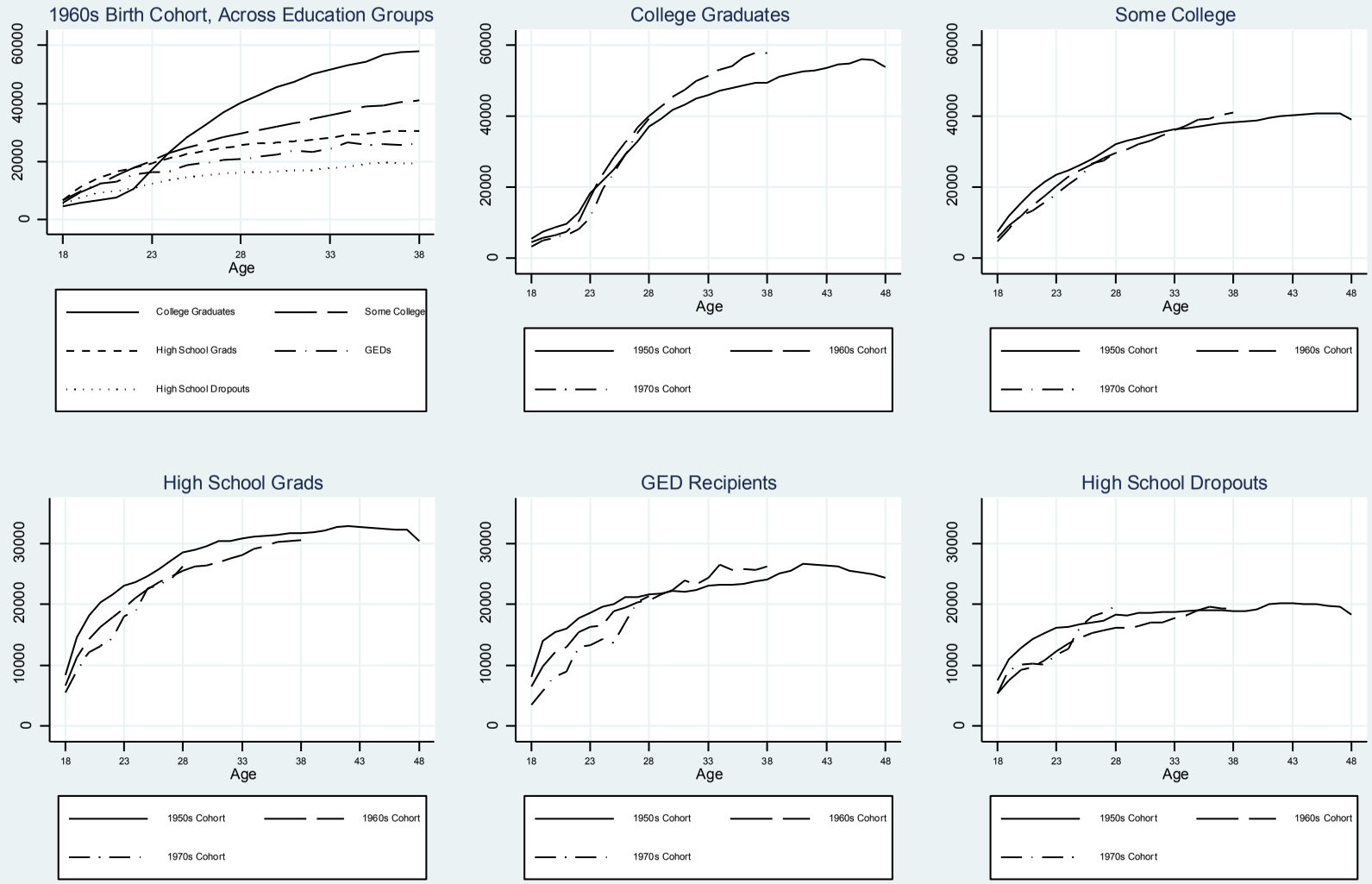
Earnings data by employer available from DER for 1978-2007.

2.5 Earnings Dynamics Over the Lifetime

2.5.1 Age-Earnings Profiles

The first panel in Figure 9 shows average earnings (in 2007 USD) for the different education groups in the 1960s cohort from age 18 until 38 (the highest age for which we observe the entire cohort). The remaining graphs demonstrate changes in the age-earnings profiles across cohorts, for different education groups (note that the x-axis ranges from 18-48 years on those graphs, and that the range of the y-axis changes for the lower panel). The first graph clearly demonstrates the skill premium: average earnings are consistently higher for groups with higher education levels. While high school dropouts, GED recipients, and high school graduates experience smooth increases in earnings over time, college graduates, as expected, show lower earnings growth during their time in college, but then quickly recover with much steeper earnings growth starting at age 22. By age 38, average earnings for college graduates were more than three times higher than for high school dropouts ($58,012 vs. $19,129). Earnings of GED recipients lie consistently between those of high school graduates and dropouts. At age 38, high school graduates earn on average 16% more than GED recipients ($30,604 vs. $26,296), who in turn earn on average 37% more than dropouts ($26,296 vs. $19,129).

Figure 9: Age-Average Annual Earnings Profiles by Education Groups and Cohort



Average annual earnings in 2007 USD.

The remaining graphs illustrate that average earnings at early ages have decreased in real terms across cohorts for all education groups, and particularly for high school graduates, GED recipients, and dropouts. For high school graduates / GED recipients / dropouts, we observe a 16% / 13% / 24% decrease between the 1950s and 1960s cohorts at age 23 ($23,079 to $19,341 for high school graduates, $18,616 to $16,267 for GED recipients, and $16,137 to $12,216 for dropouts), and an additional 7% / 18% / 5% decrease between the 1960s and 1970s cohorts (to $17,963 for high school graduates, $13,297 for GED recipients, and $11,657 for dropouts). For college graduates, average earnings at age 23 decreased from $18,225 for the 1950s cohort to $17,059 for the 1960s cohort (a 6% decrease) to $11,564 for the 1970s cohort (an additional 3% decrease). It is possible that the decrease for college graduates might be explained by this group working lower-skill jobs during their college years, for which real earnings decreased over time. It is also possible that hours of work declined for this group during the years in which they mix work and schooling.

While average earnings for college graduates in real terms are higher in the 1960s cohort compared with the 1950s cohort starting at age 24, average earnings remain lower in the more recent cohort throughout the age range observed in both (until age 38) for high school graduates, are higher only from age 30 onward for GED recipients, and from age 35 onward for dropouts. Less-educated individuals have thus lost real earnings across cohorts for most of their 20s and 30s, with GED recipients faring slightly better than high school graduates and dropouts.

2.5.2 Between-Job and Within-Job Earnings Growth

Topel and Ward (1992) estimated for their sample of white males born between 1939 and 1948 that individuals' earnings increase by an average of 11.4% at job transitions during their first 10 years of experience, compared with only 1.75% average annual within-job earnings growth. The following section explores how the ratio of between-job to within-job earnings growth has changed over time since the 1970s. It also shows differences in the importance of job transitions for earnings growth among education groups.

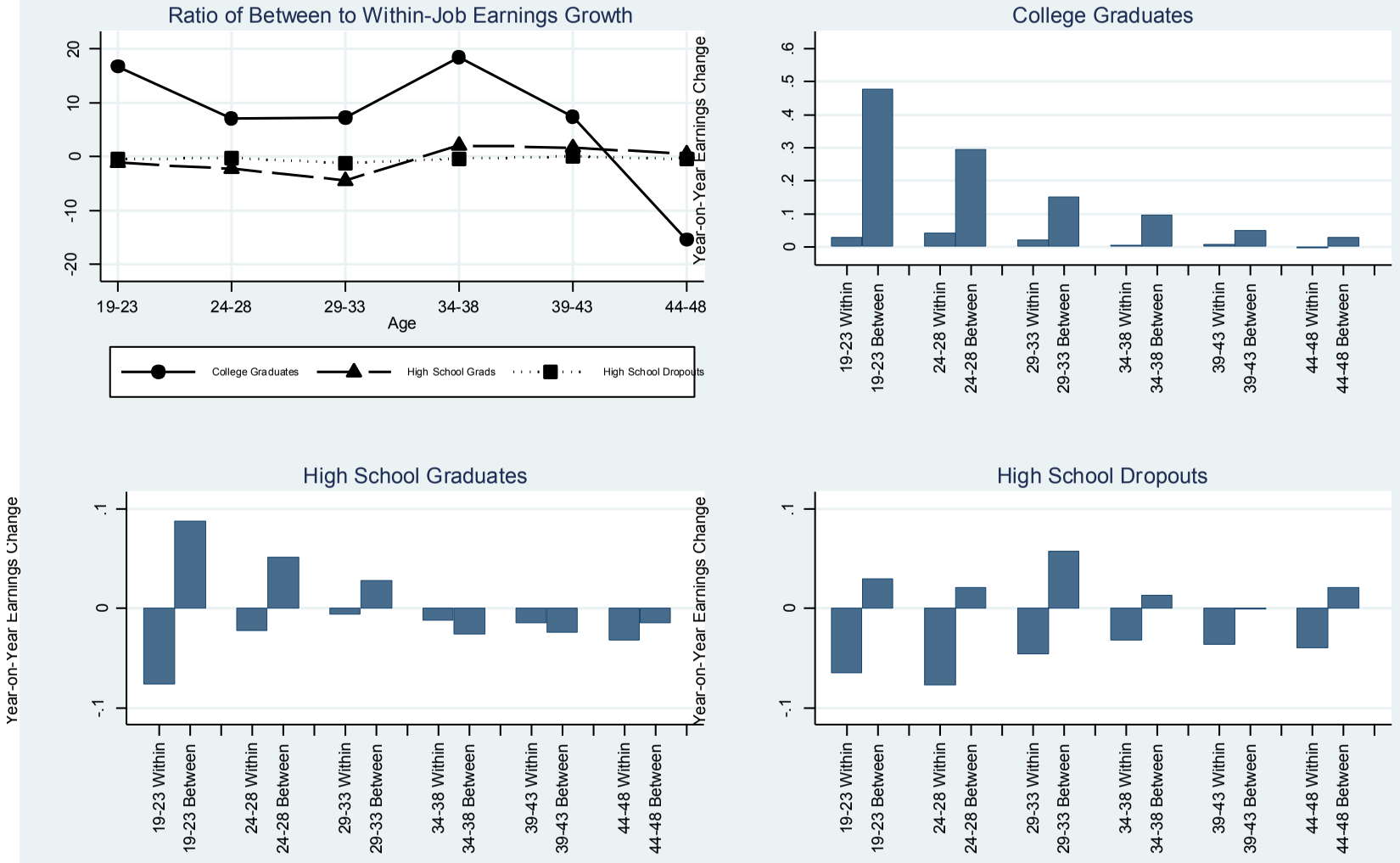
Figures 10A, 10B, and 10C illustrate between- and within-job earnings growth (in real terms) for the 1950s, 1960s, and 1970s cohorts, respectively. While we observe individuals from the beginning of their career until age 48 for the 1950s cohort, we observe the 1960s cohort only until age 38, and the 1970s cohort only until age 28. Between-job earnings growth is defined as the change in annual earnings if the employer who provides the main earnings changes. Within-job earnings growth refers to the change in annual earnings if the main employer remains the same across two years. For within-job earnings growth, we consider only jobs that an individual held for four or more years, and calculate growth between year 2 and 3, in order to ensure that our results are not skewed by mid-year separations. Similarly, for between-job earnings growth, we require at least two years of earnings in both the first and the second job, and calculate earnings growth between the last year, in which the previous job provided main earnings, and the first year, in which the next job provided main earnings.

The second, third and fourth graphs in Figure 10A illustrate the differences in average within- and between-earnings growth in different age groups for college graduates, high school

graduates, and dropouts. We observe that college graduates on average experience positive earnings growth both within- and between jobs throughout their career (apart from the exception of a -0.2% average within-job growth for age group 44-48). Both between- and within-job growth is decreasing across the lifetime for this highest educated group. While between (within)-job growth averages 48% (3%) in the 19-23 age group, when individuals transition from college to their first full-time job, it decreases to 5% (1%) in the 39-43 age group. This is consistent with the concave shape of the age-average earnings profile in Figure 9.

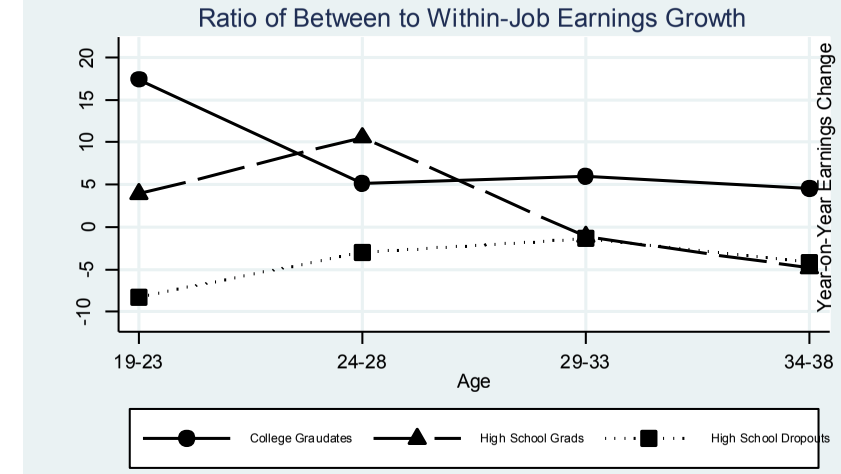
Within-job wage growth is thus consistently much lower than between-job growth. The pictures for high school graduates and dropouts paint a very different picture. First, earnings growth, whether within- or between-jobs, is significantly lower than for college graduates. Compared to the latter's 48% between-job earnings growth for age group 19-23, high school graduates only experience 9% growth, and dropouts only 3% at the same ages. Second, while college graduates experience positive real earnings growth even if they remain with the same employer, real earnings of high school graduates and dropouts *decrease* in real terms within the same job across all age groups. Third, while high school graduates mirror the decrease over the lifetime in between-job earnings growth, albeit at lower levels, until the mid-20s, dropouts experience their largest between-job earnings growth in the 29-33 age group.

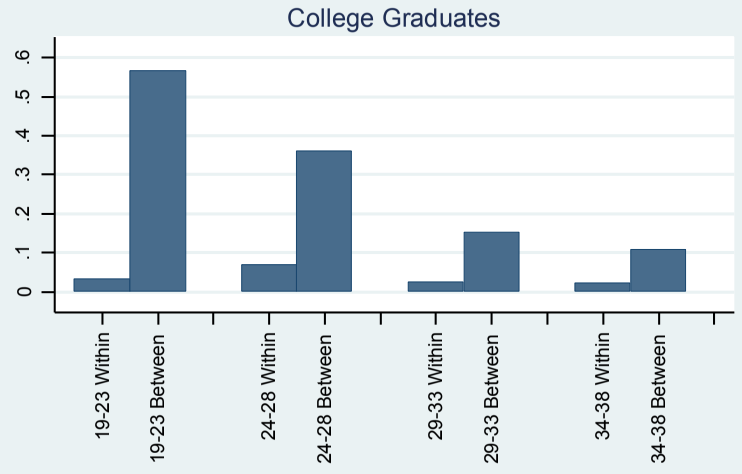
Figure 10A. Within-Job Relative to Between-Job Earnings Growth: 1950s Cohort

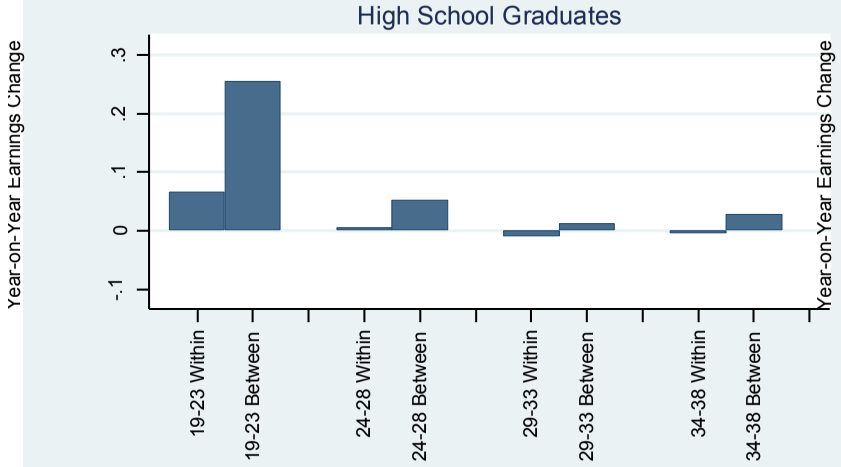


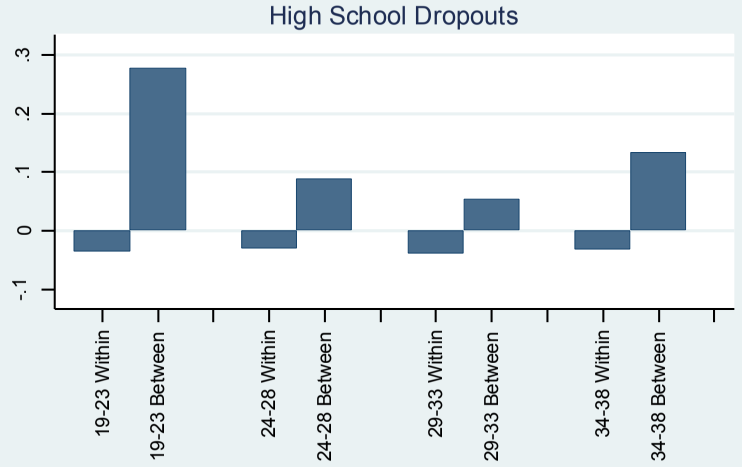
Average annual earnings in 2007 USD.

Figure 10B. Within-Job Relative to Between-Job Earnings Growth: 1960s Cohort

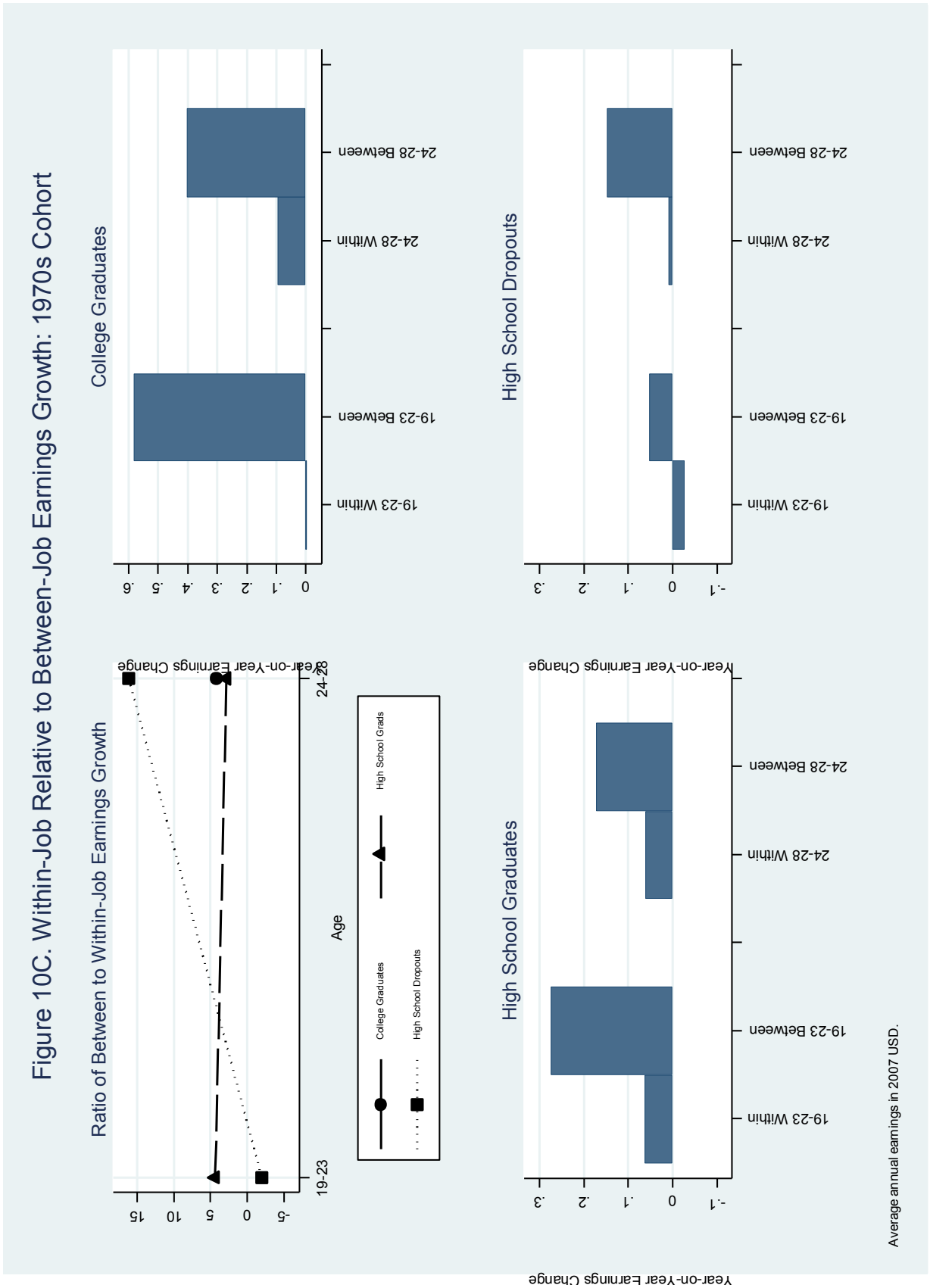








Average annual earnings in 2007 USD.



The first graph of Figure 10A combines those results by considering changes in the ratio of

between-to-within-job earnings growth across the lifetime. Given negative within-job earnings growth for the less-educated groups, this ratio is difficult to interpret. For college graduates, we show that the ratio is very high for age groups 19-23 and 34-38 (16.6 and 18.4), and lower (between 7.0 and 7.4) for the remaining age groups until age 43.

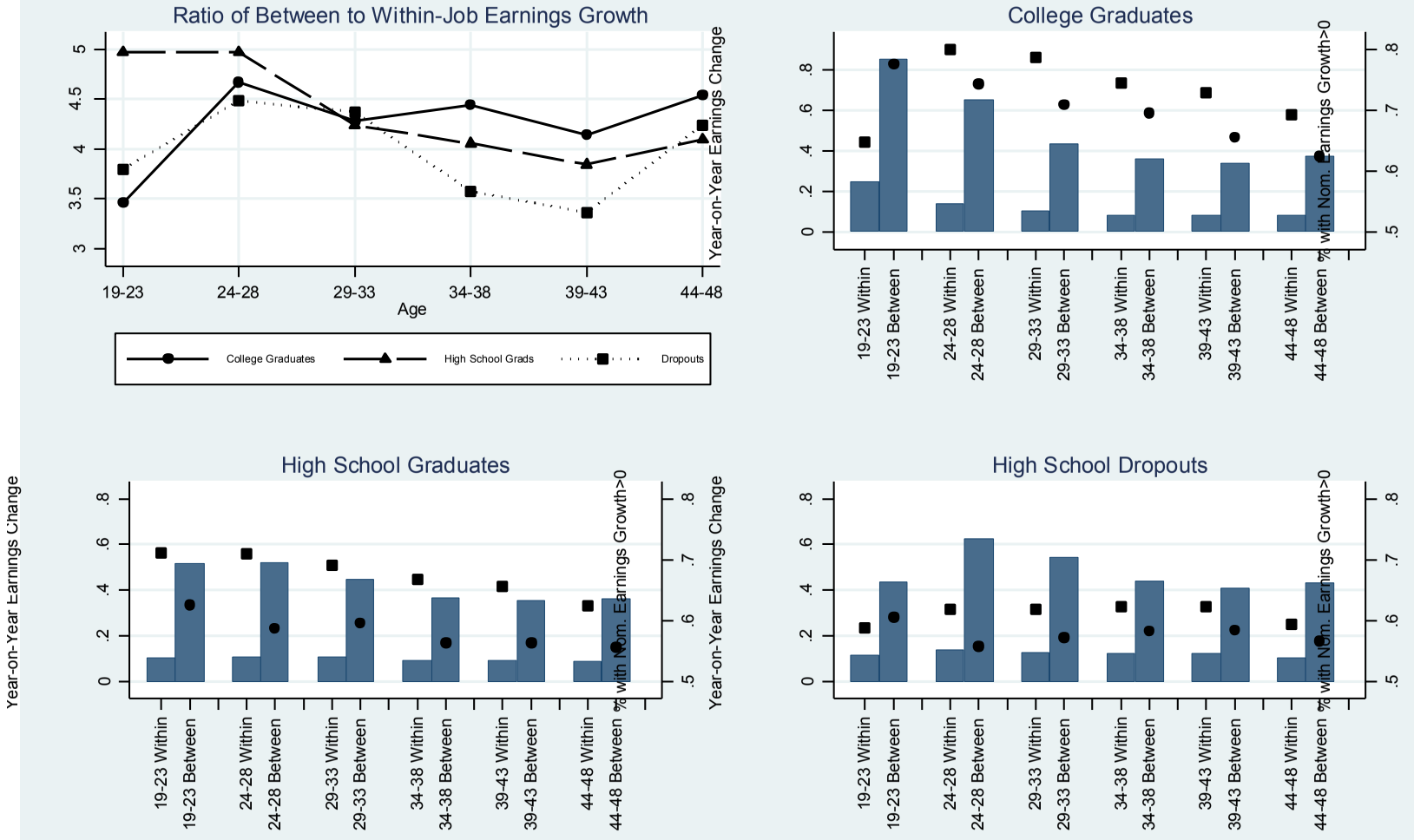
Figures 10B and 10C, which replicate Figure 10A for the 1960s and 1970s cohorts, point out several changes over time. First, between-job earnings growth for college graduates has increased across cohorts consistently (e.g. for age group 19-23, from 48% in the 1950s cohort to 57% in the 1960s cohort, to 58% in the 1970s cohort). Second, between-job growth for the less educated continues to remain significantly lower than for college graduates, but increased markedly between the 1950s and 1960s cohorts (e.g. for high school graduates (dropouts) in age group 19-23, from 9% (3%) in the 1950s cohort, to 26% (28%) in the 1960s cohort. Third, within-job earnings growth turns positive in the 19-23 and 24-28 age groups for high school graduates in the 1960s and 1970s cohorts, although it continues to linger at low levels (0-6%), and continues to be negative past age 28. Within-job earnings growth remains negative for dropouts in the 1960s and 1970s cohorts.

The findings from Figures 10A-10C can help reconcile several of our previous stylized facts: On the one hand, Figure 9 illustrated that dropouts do reach average earnings beyond our $10,000 threshold for significant earnings by age 19-22 (depending on the cohort), and remain closer to $20,000 in annual earnings for the rest of the career. On the other hand, Figures 5A and 5C showed that while dropouts hold the highest number of cumulative jobs with any earnings at all ages, they hold the lowest number of jobs with significant earnings. In line with the high

number of any cumulative jobs, Figure 7A showed that dropouts have the lowest average tenure across all ages relative to those higher educated, as well as the highest exit hazards, particularly at younger ages (Figure 8B). Our findings on between- and within-job earnings growth in Figures 10A-10C explain that “stable” jobs with the same employer over time are not lucrative for the least educated, as their real earnings decrease over time. High school dropouts therefore often change frequently from one “bad” job to another, as this will at least offer some, if relatively low, real earnings growth on average.

Figure 11A. Within-Job Relative to Between-Job Earnings Growth: 1950s Cohort

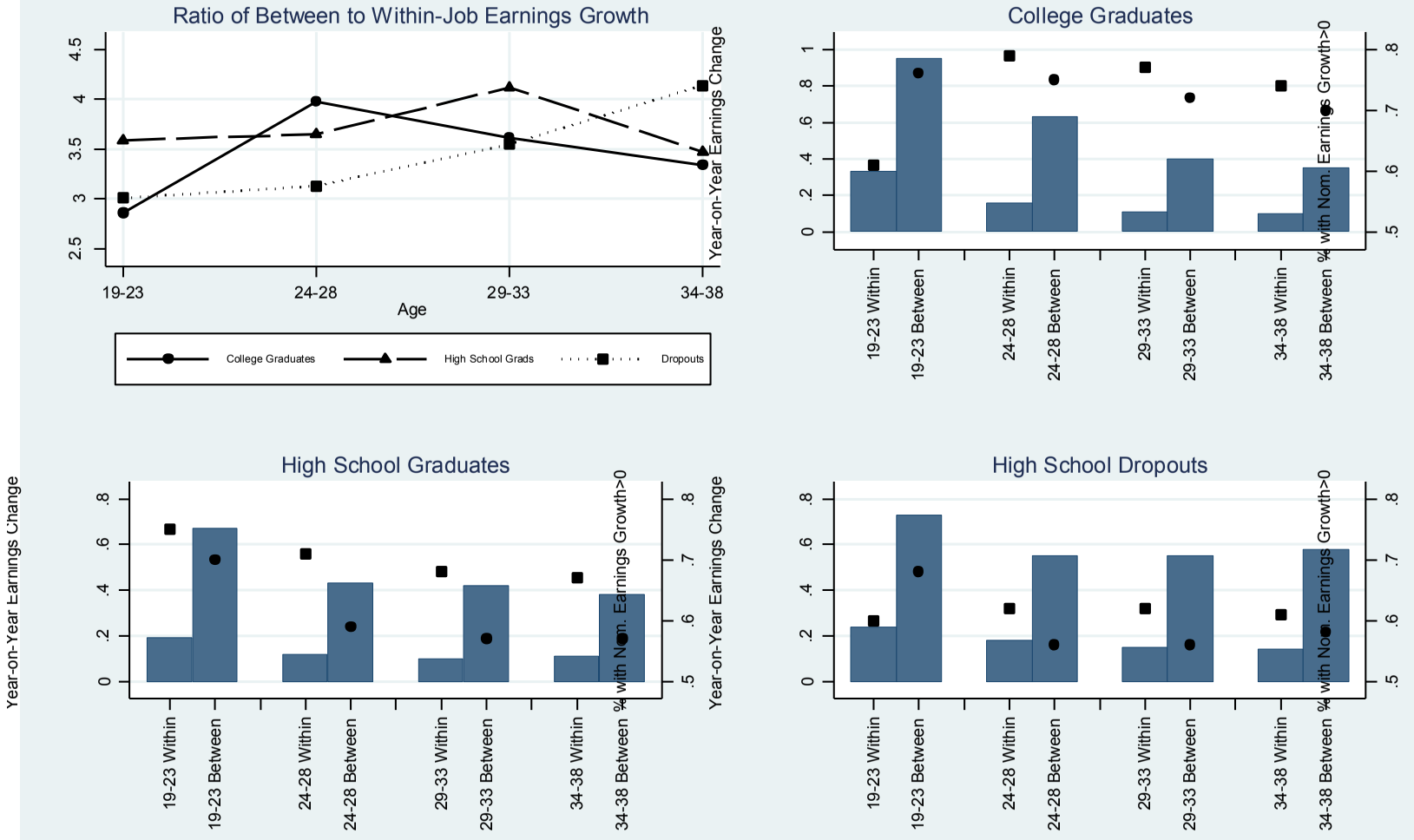
Only Individuals with Positive Nominal Wage Growth



Average annual earnings in 2007 USD.

Figure 11B. Within-Job Relative to Between-Job Earnings Growth: 1960s Cohort

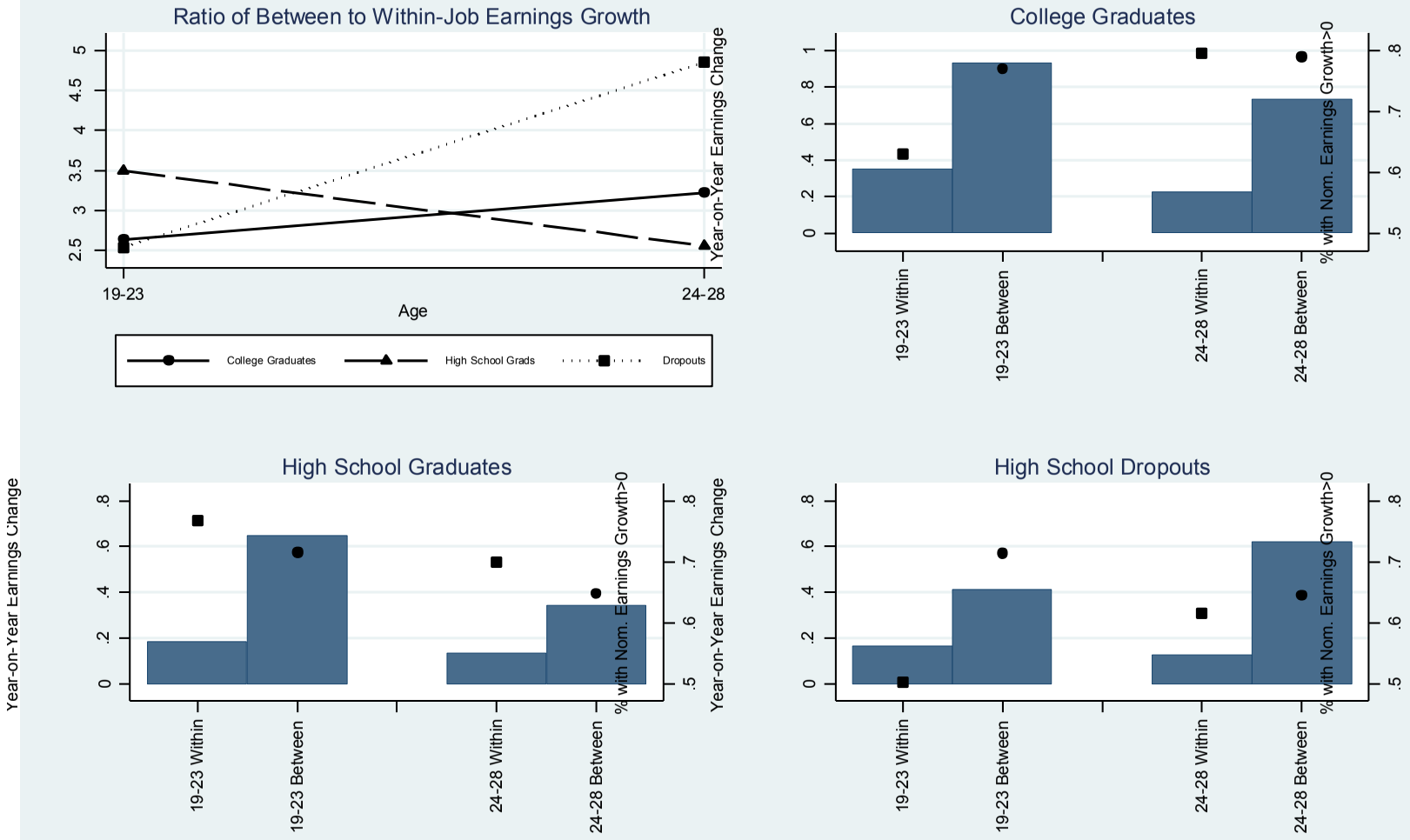
Only Individuals with Positive Nominal Wage Growth



Average annual earnings in 2007 USD.

Figure 11C. Within-Job Relative to Between-Job Earnings Growth: 1970s Cohort

Only Individuals with Positive Nominal Wage Growth



Average annual earnings in 2007 USD.

Figures 11A-11C replicate the analysis of Figures 10A-10C, but exclude all observations of negative or zero nominal earnings growth. The squares and circles on the second, third, and fourth graphs of each figure illustrate the percentage of the sample that is included in these graphs, i.e. the percentage with positive nominal earnings growth, for the within-job and between-job growth calculations, respectively (refer to second y-axis on the right-hand side of graphs). Apart from exceptions during early age groups, the percentage with positive nominal earnings growth is consistently higher for within-job relative to between-job observations for all education groups. We observe large differences across education categories, however. While for college graduates, the percentage of observations with positive within-job earnings growth in the 1950s cohort (Figure 11A) decreases from its highest level in the 24-28 age group of 80% to 69% in the 44-48 age group, the equivalent percentages for less-educated groups are much lower (from 71% to 62% for high school graduates, and relatively stable between 59% and 62% for dropouts). Similar differences across education groups hold true for the percentage of the sample with positive nominal between-job earnings growth: for college graduates, this percentage moves from 78% to 63%, for high school graduates from 63% to 56%, and for dropouts it remains between 56% and 61%. The less-educated are thus more likely to experience negative nominal annual earnings growth, whether they remain in the same main job, or change main employers. We observe similar trends in the percentage of individuals with positive nominal earnings growth in the 1960s cohort (Figure 11B).

The bars in the second, third and fourth graphs of Figures 11A-11C illustrate the differences between within-job and between-job growth across the lifetime, as in Figures 10A-10C. When we exclude, as in Figures 11A-11C, observations with negative nominal earnings growth,

differences between education groups diminish markedly. While college graduates still exhibit higher between-job earnings growth in earliest age group from 19-23 (in the 1950s cohort, 85%, as opposed to 52% for high school graduates, and 44% for dropouts), the differences disappear thereafter (e.g. in age group 29-33 in the 1950s cohort, 43% for college graduates, 45% for high school graduates, and 54% for dropouts). A similar trend can be observed for within-job earnings growth: while college graduates experience higher growth at very early ages as they exit college into their first full-time job, within-job earnings growth thereafter is higher for high school graduates and dropouts if we only consider those with positive nominal earnings growth. The first graphs in Figures 11A-11C illustrate the resulting ratios of between- to within-job growth across time. In the 1950s cohort, while high school graduates have the highest ratio during the 20s, the ratio for college graduates exceeds other education groups for the 30s and 40s. These findings point to a significant heterogeneity among high school graduates and dropouts. In our discussion of figures 10A-10C we showed that the less-educated groups experienced on average negative within-job earnings growth and switched jobs frequently to retain an earnings level. However, when we exclude the minority of less-educated individuals who experiences negative nominal earnings growth, as in Figures 11A-11C, we observe that high school graduates and dropouts perform surprisingly well compared to college graduates.

2.6 Conclusion

This paper uses earnings and benefit data from the Social Security administration to analyze the labor market experiences of American men born over four decades (1940-1979). We compare our findings with the seminal paper by Topel and Ward (1992) who last used administrative data to systematically study labor market experiences, focusing on a sample of white males born between 1939 and 1948. We show that several of Topel and Ward's (1992) findings mask substantial heterogeneity by education group already in the cohort that they studied. Moreover, our results illustrate broad changes in the experience of American men across cohorts. Individuals born in the 1970s did not encounter the same labor market as those born in the 1940s.

Topel and Ward (1992) estimated that 74% of white males hold their first full-time job by age 21. We show that in the cohort they studied, the equivalent percentage is 51% (68%, 82%) when considering only college graduates (high school graduates, high school dropouts). Looking at more recent cohorts, we show that the percentage achieving significant earnings by age 21 has decreased significantly. This is true for all education categories apart from high school dropouts (for example for GED recipients from 85% in Topel and Ward's (1992) cohort to 45% in the 1970s cohort).

At the same time, we also observe a rapid increase across cohorts for the less-educated groups in the percentage of individuals *without* significant earnings by age 28. Between the 1940s and 1970s birth cohort, the percentage who had not achieved $10,000 annual earnings by age 28 increased from 10% to 19% among high school dropouts, from 1% to 17% for those with a GED,

and from 4% to 14% for high school graduates. Of those individuals who did not reach significant earnings by age 28, a significant and increasing fraction are supported by DI or SSI: In the 1970s birth cohort, 55% of high school graduates, 42% of high school dropouts, and 29% of GED recipients without significant earnings are either DI or SSI benefit recipients by the age of 28.

Analyzing the number of years worked over the lifetime, we find that high school graduates work the most (21.3 of 30 possible years), followed by college graduates (20.5 years), and high school dropouts (16.1 years). While more than half of high school graduates work significant jobs for all of the first ten years of labor market experience in the most recent cohort, less than a third of high school dropouts do so. However, when we consider any earnings, we show that a large majority of dropouts (67%-73% depending on the cohort) work consistently (at least 8 out of 10 years) during the first ten years, but for many of these years they do not reach the $10,000 threshold that we define as significant earnings.

Dropouts hold the lowest cumulative number of significant jobs at all ages, relative to high school and college graduates, but the highest number of any jobs. By age 58, we estimate that college graduates have held 5.9 jobs with significant earnings, compared with 5.1 jobs for high school graduates, and 4.1 jobs for dropouts. When considering any earnings, the cumulative job numbers are 16.0, 17.7, and 19.3, respectively. For all education groups, and in particular among high school dropouts, workers have become much more heterogeneous in more recent cohorts in terms of the number of any jobs held, with comparable fractions changing job every year, and holding only one job across the first ten years.

Topel and Ward (1992) estimated that two thirds of all jobs end in the first year. Our results show that those jobs are disproportionately held by the less-educated. Across all cohorts, dropouts have the lowest average tenure at all ages. At age 38, almost half of dropouts have 1 or 2 years of tenure, compared with 35% of high school graduates, and 30% of college graduates.

Topel and Ward (1992) found that average earnings in their sample grew at approximately 11% annually for the first 10 years, and that wage gains at job changes are about 10%, making up approximately half of total wage growth. We show that there is substantial heterogeneity across education group in terms of wage growth, and where it happens. Average real earnings growth, whether within- or between-job, is significantly higher for college graduates than for less-educated groups. While college graduates, on average, experience positive real earnings growth even if they remain with the same employer, earnings of high school graduates and dropouts decrease on average in real terms within the same job and this is true across all age groups. Workers in lower education groups do on average experience earnings growth when they switch jobs. This is particularly true at younger ages, when high school graduates and dropouts gain on average more than 25% in earnings following a job change.

In particular among the least educated we find enormous heterogeneity along all dimensions analyzed. While some high school dropouts progressively lose real earnings when they stay in the same job, change jobs frequently, and remain at low tenure levels throughout their lifetime, others manage to establish stable careers with high tenure, low exit hazards, and surprisingly good real earnings growth starting in their late 20s.

Chapter 3

The Health Status of Social Security Disability Insurance and Supplemental Security Income Recipients

3.1 Introduction

The percentage of working-age Americans receiving disability benefits has increased significantly over recent decades. While some scholars claim that this process can be explained mostly by the aging of baby-boomers, who entered prime ages for disability receipt, others point to a more lenient system of disability determination. Liebman (2014) shows that there has been an increased incidence related to musculoskeletal and mental conditions, in the absence of which the number of beneficiaries today would be 21 percent lower. At the same time, the number of circulatory diagnoses among disability recipients has decreased. Liebman (2014) poses the puzzle as to whether the rising incidence of musculoskeletal and mental conditions reflects more lenient criteria and increased incentives for low-wage workers to claim benefits, or rather a reclassification of circulatory cases as musculoskeletal or mental cases.

If the system has, indeed, become more lenient, we should observe an improvement in the health status of disability recipients, in particular among diagnosis codes that have become more frequent, such as musculoskeletal and mental conditions. This paper aims to provide evidence on the health status of disability recipients over time. We use administrative benefit records from the Social Security Administration, matched to data from the Survey of Income and Programs Participation (SIPP) on self-reported health status, including measures of limitations in basic and instrumental Activities of Daily Living (ADLs).

The preliminary results presented in this paper indicate that male OASDI disability recipients become healthier on average between 1984 and the early 1990s across various health measures. This is not surprising because after eligibility requirements were tightened in the late

1970s and early 1980s, the 1984 reforms reversed the tightening, in particular by allowing multiple impairments to cumulatively qualify an individual for benefits even if each impairment on its own would not have. In addition, some measures suggest continued health improvements since the early 1990s. Most of the average health improvement is driven by two forces: 1) a selection effect, due to an increasing fraction of recipients with mental disorder diagnoses, who are on average healthier across all measures, and 2) a pronounced improvement in health status for those with musculoskeletal diseases, a growing diagnosis category. The improvement, in particular for those with musculoskeletal impairments, is most pronounced when we measure non-severe impairments (instrumental ADLs). While those with severe impairments have also become healthier over time, it seems that the average health status improvement is mainly due to those with less-severe impairments reporting significantly fewer limitations in more recent years. Because these results do not yet fully control for changes in the population age distribution or for business cycle trends, they should be considered preliminary.

3.2 Data

We use data from the Survey of Income and Program Participation (SIPP), a nationally representative longitudinal survey of households conducted by the U.S. Census Bureau. Participating individuals are interviewed every 4 months over a period of two to four years. In this paper, we use data from the SIPP panels starting in 1984, 1990, 1991, 1992, 1993, 1996, 2001, and 2004. In particular, we use questions on the health status of SIPP respondents. Those

questions were administered as part of the Topical Module on Functional Disabilities in each panel[30]. Respondents were asked about their subjective health status, as well as the basic Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) battery of questions. The ADL and IADL questions address physical and mental conditions affecting the respondent, the use of mobility aids, vision and hearing impairments, speech difficulties, lifting and aerobic difficulties, and the ability to function independently within the home.

By becoming special sworn Census employees, we were able to match these SIPP panels to administrative data from the Social Security Administration's Master Beneficiary Records (MBR), the Supplemental Security Record (SSR), and the Payment History Update System (PHUS). These administrative data are unaffected by common survey data concerns such as attrition, misreporting, or non-response, and provide panel data for respondents in the SIPP on their lifetime history of retirement and disability benefit applications, decisions, and receipt.

The MBR file includes OASDI disability records from 1962 to 2007, including data on the type of benefit, dates of application, approval, denial, and entitlement, the disability onset date, as well as primary and secondary diagnosis codes. The SSR file includes the equivalent data for SSI applications, from 1974 to 2007. The PHUS records actual monthly payments received (rather than payments an individual was entitled to, which might have been paid out retroactively), from 1984 to 2007.

[30] The Topical Module on Functional Limitations / Disability was administered in the following panels and waves: panel 1990: waves 3 and 6, panel 1991: wave 3, panel 1992: waves 6 and 9, panel 1993: waves 3 and 6, panel 1996: waves 5 and 11, panel 2001: waves 5 and 8, panel 2004: wave 5. The 1984 panel, which we also include in the analysis, has a different structure from the subsequent panels. Some, but not all relevant questions were included in the Topical Module on Health and Disability for this panel (wave 3).

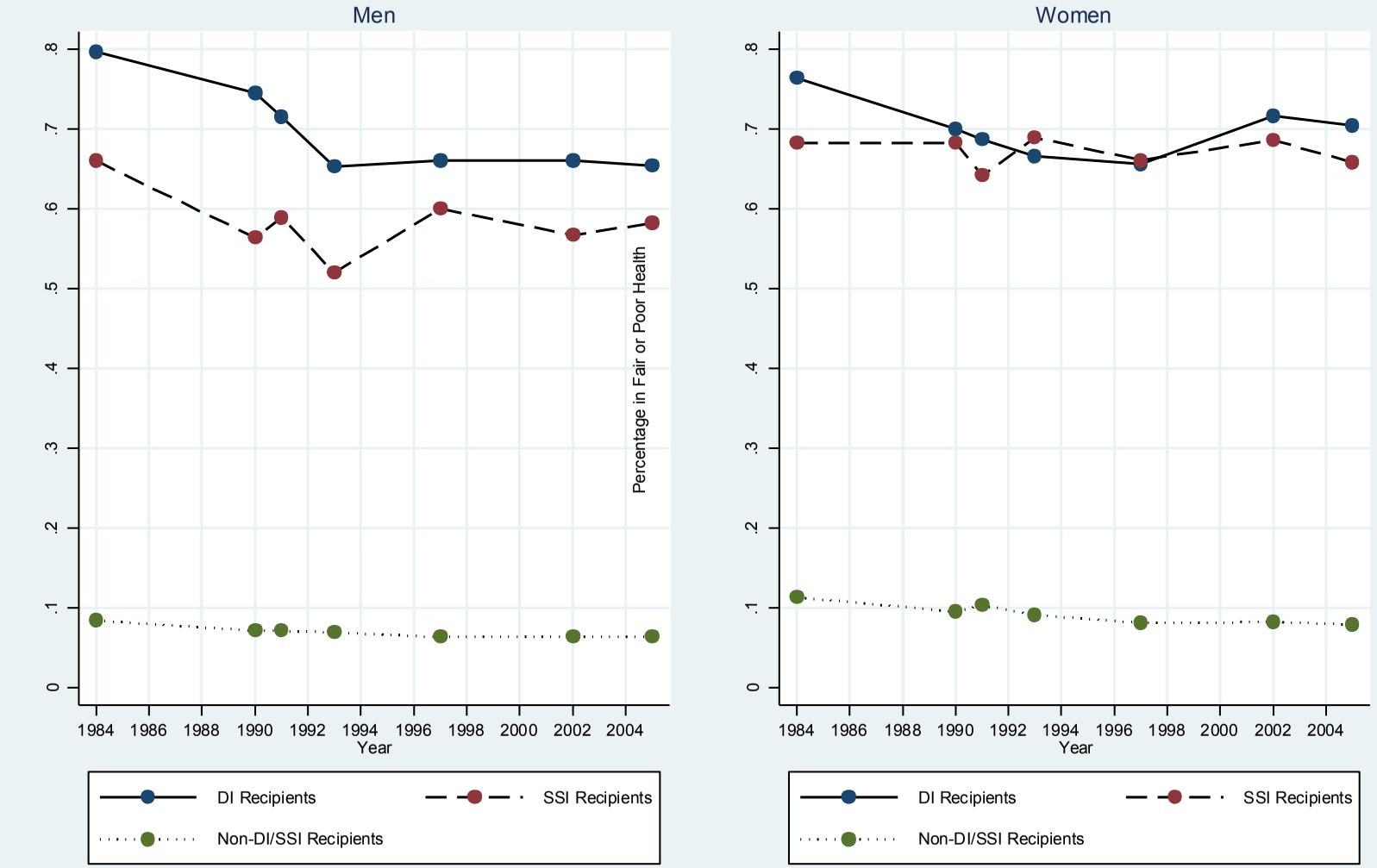
We use the MBR and SSR files to identify OASDI disability and SSI working-age recipients among the nationally representative sample of SIPP respondents. For this population, we then study health status based on SIPP variables from the Topical Modules on Functional Disabilities over time in repeated cross-sections.

3.3 Empirical Observations

Figure 3.1 illustrates the percentage of OASDI disability and SSI recipients, as well as non-disabled individuals who responded that they are in fair or poor health[31]. This graph is not adjusted for the age composition of benefit recipients. While approximately 80% of male OASDI disability recipients reported fair or poor health in the mid-1980s, this fraction decreased to around 65% by 1993, and remained relatively stable since then. This improvement in the average health status of OASDI disability recipients took place against the backdrop of a relatively stable average health status of non-OASDI or SSI recipients. Approximately 6-8% of non-recipients report fair or poor health status. A lower fraction of male SSI recipients relative to OASDI disability recipient reported fair or poor health status throughout the time period studied. In 1984, 66% of SSI, compared to 80% of OASDI disability recipients responded that their health status was fair or poor. The fraction of SSI recipients in fair or poor health also decreased initially to 52% in 1993, but increased again to 66% in 2005. These results are consistent with the incidence trends described in Liebman (2014) -- which show a bounce back

[31] The SIPP question offered the following options to describe the respondent's health status: excellent, very good, good, fair, and poor.

Figure 3.1: Percentage of DI, SSI, and Non-DI/SSI Recipients in Fair or Poor Health

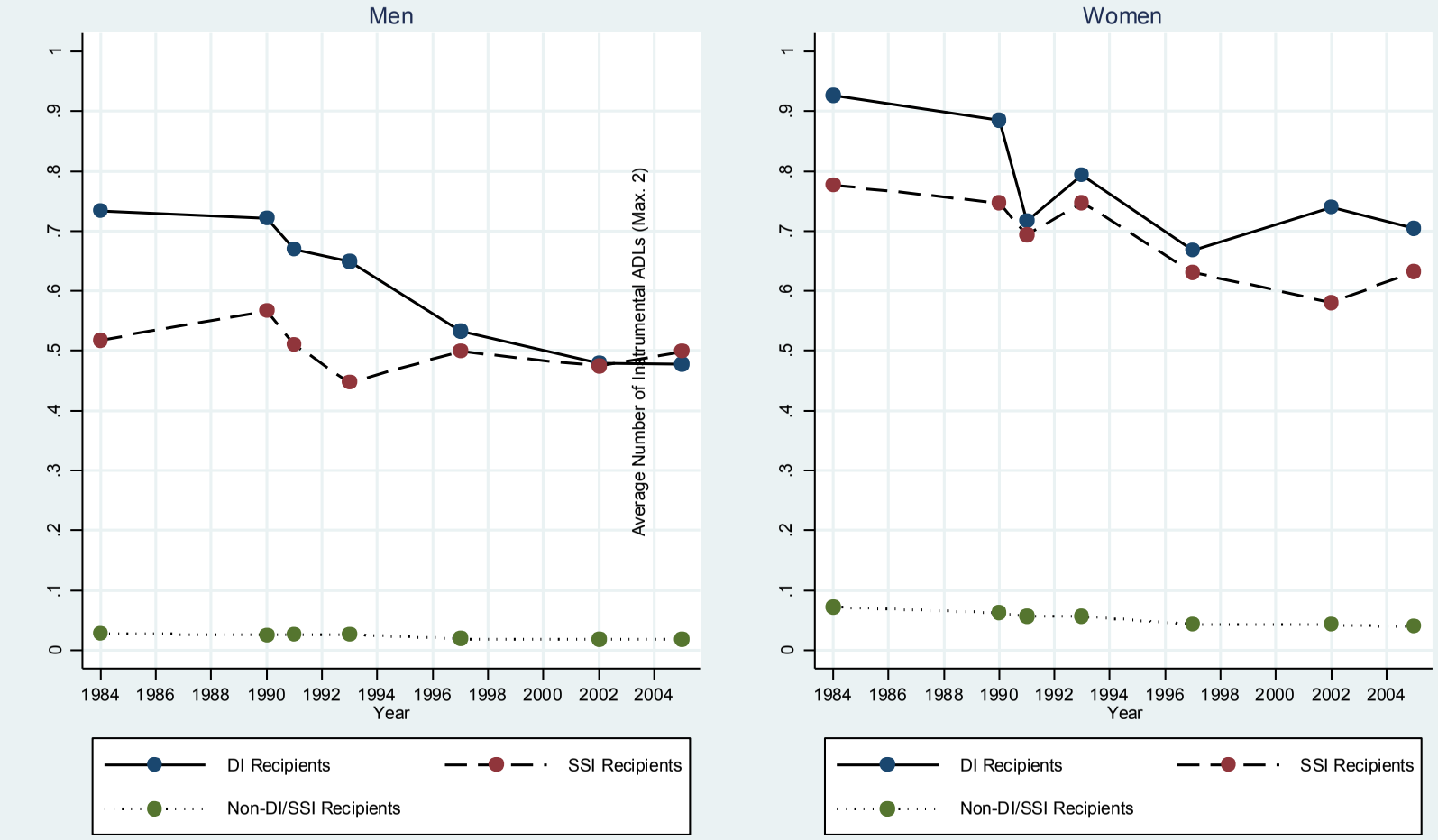


Note: Health status self-reported in SIPP Topical Modules with the options 'excellent, very good, good, fair, poor'.

in incidence rates in the immediate aftermath of the 1984 reforms, but little further increase in incidence after the early 1990s.

Liebman (2014) shows that as the baby boomers moved through the workforce, the average age of both male and female disability recipients decreased from the early 1980s until about 1993, due to a surge in younger workers, after which average age increased as baby boomers reached older ages. Because these preliminary results are not age adjusted, some of the improvement in health status observed from 1984 to 1993 could be the result of the changing age distribution of the DI-eligible population and might therefore not reflect more lenient eligibility criteria. Figure 3.1 also shows an improvement in the health status of female OASDI disability recipients from 76% in fair/poor health in 1984 to 66% in 1997. In contrast, the self-reported health status of female SSI recipients remained relatively constant over the entire period studied. Even if the observed improvement in reported health status of female benefit recipients is an artifact of a changing age composition for the period from 1984 to 1993, the improvement from 1993 to 1997 is likely real. During this time period, the average age of benefit recipients increased markedly (Liebman 2014), which would bias our health status estimates downward. The observed improvement in health status is therefore likely understating the true change for that period.

Figure 3.2: Average Number of Instrumental ADLs (Max. 2) for DI and SSI Recipients



Instrumental ADLs self-reported in the SIPP Topical Module.
Instrumental ADL variables available starting with panel 1984: difficulty
(1) lifting and carrying something as heavy as 10 lbs, such as a full bag of groceries,
(2) difficulty getting around outside the home.

Figure 3.2 illustrates another health measure for OASDI disability and SSI recipients over time: the average number of instrumental ADLs. Unfortunately, we only observe two instrumental ADLs consistently from 1984 to 2005, given that the remaining ADL questions were only added in the 1990 panel. The IADLS observed continuously are whether a respondent has difficulty lifting and carrying something as heavy as 10 lbs, such as a full bag of groceries, and whether she has difficulty getting around outside the home. This graph illustrates the average number (out of a maximum of two) of instrumental ADLs. As in Figure 3.1, we show that the health status of non-recipients is relatively constant. However, the average number of IADLs in particular for male OASDI disability recipients decreased over the period studied, from 0.73 in 1984 to 0.48 in 2005. In contrast, the health status of male SSI recipients as measured by the average number of IADLs remains relatively stable over time.

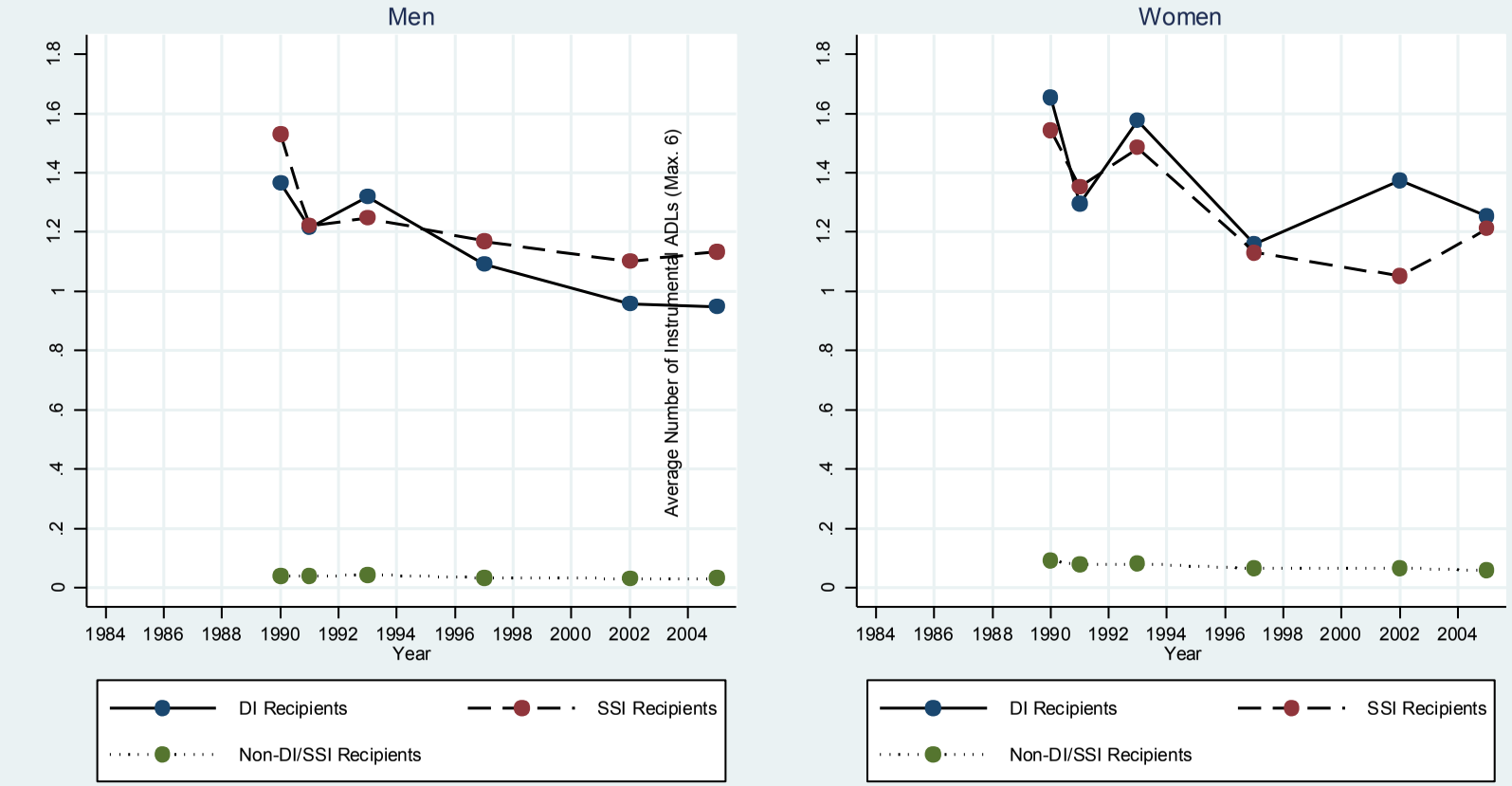
The right panel of Figure 3.2 focuses on female recipients. Here we observe a decrease in the average number of IADLs reported by both OASDI disability and SSI recipients until 1997 and 2002, respectively. Once again, this suggests that also female recipients have become less impaired over time, particularly between 1993 and 1997, when we know that average age of recipients had increased. Moreover, compared to men, this panel also shows that female recipients have a higher number of IADL limitations. Most recently, in the 2005 SIPP wave, female OASDI disability recipients claimed on average almost 50% more impairments (0.71 out of 2 possible impairments, compared with 0.48 for male OASDI disability recipients).

Figure 3.3 replicates the analysis of Figure 3.2, but considers a broader array of instrumental ADLs, which are available starting with the 1990 SIPP panel. In addition to the two IADLs

included in Figure 3.2, we now also consider responses to questions on difficulty keeping track of money and bills, preparing meals, doing light housework, and using the telephone.

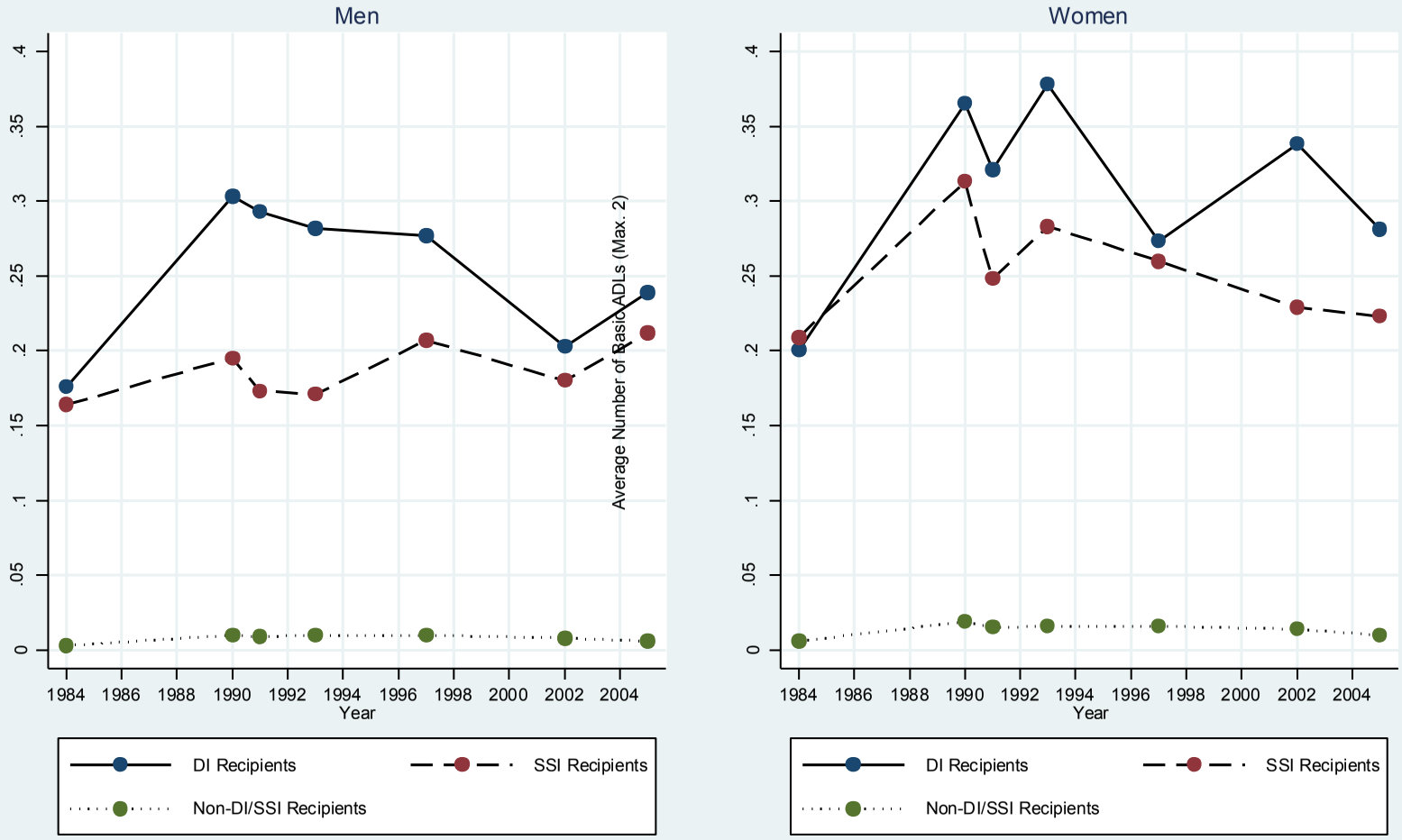
Figure 3.3 represents the average number of out of those possible 6 limitations for benefit recipients. Particularly for male recipients, this graph confirms our previous finding, that OASDI disability recipients have become less limited in terms of IADLs over time. In 1993, male OASDI disability recipients had an average of 1.36 out of 6 possible limitations, which decreased to 0.95 by 2005. Over the same period, average age of recipients increased from 49.5 to 51.5 (Liebman 2014), which we would expect to have the opposite effect on IADLs reported. Figure 3.3 thus likely underestimates the extent to which more recent OASDI disability recipients have an improved health status on average. Figure 3.3 also illustrates a decrease in the number of IADLs reported by SSI recipients over time, although less pronounced than for OASDI disability recipients. While the trend for female benefit recipients is less consistent, we nevertheless observe an overall decrease in the number of IADLs over time. While Figure 3.3 confirms the finding that female OASDI disability recipients face on average more limitations than male recipients, the average number of limitations is much more similar across genders for SSI recipients.

Figure 3.3: Average Number of Instrumental ADLs (Max. 6) for DI and SSI Recipients



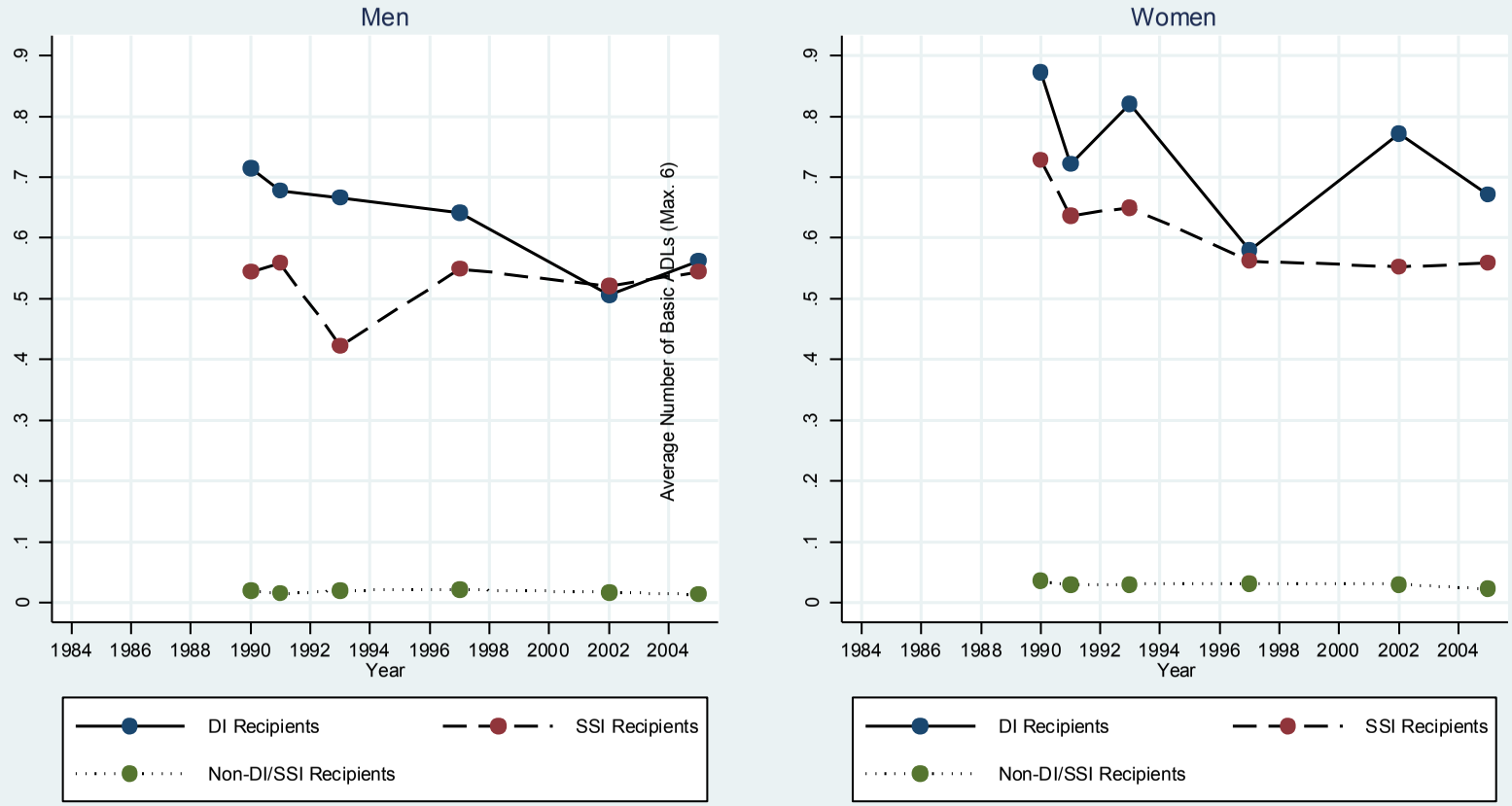
Instrumental ADLs self-reported in the SIPP Topical Module.
Instrumental ADL variables available starting with panel 1990: difficulty
(1) lifting and carrying something as heavy as 10 lbs, such as a full bag of groceries,
(2) difficulty getting around outside the home,
(3) keeping track of money and bills,
(4) preparing meals,
(5) doing light housework,
(6) using the telephone.

Figure 3.4: Average Number of Basic ADLs (Max. 2) for DI and SSI Recipients



Basic ADLs self-reported in the SIPP Topical Module.
Basic ADL variables available starting with panel 1984:
(1) difficulty moving around inside the house,
(2) difficulty getting in and out of bed.

Figure 3.5: Average Number of Basic ADLs (Max. 6) for DI and SSI Recipients



Basic ADLs self-reported in the SIPP Topical Module.
Basic ADL variables available starting with panel 1990: difficulty
(1) moving around inside the house,
(2) getting in and out of bed,
(3) taking a bath or shower,
(4) getting dressed,
(5) eating,
(6) using the toilet.

Figures 3.4 and 3.5 offer additional ways to measure the health status of benefit recipients over time, focusing on basic ADLs. Figure 3.4 focuses on those two basic ADLs for which data are available for all panels (difficulty moving around inside the house, and difficulty getting in and out of bed). Figure 3.5 illustrates the average number of a broader set of basic ADLs that are available starting with the 1990 panel. In contrast to Figure 3.1 and 3.2, which showed improving health status of benefit recipients also between panels 1984 and 1990, Figure 3.4 suggests that average health status as measured by the number of basic ADLs deteriorated between the first two SIPP panels. Thereafter, however, the conclusions from the previous graphs are confirmed: There is a downward trend in the average number of limitations an OASDI disability recipient reports throughout the 1990s, in particular for men. The trend for women is again less clear, but particularly for female SSI recipients, health status as measured by basic ADLs is also improving over time.

Tables 3.1 to 3.4 translate the findings from the previous Figures into a regression framework. We regress our different measures of health status (indicator for fair or poor health, number of basic ADLs (out of 2 possible), number of basic ADLs (out of 6 possible), number of instrumental ADLs (out of 2 possible), number of instrumental ADLs (out of 6 possible) on year dummies, state unemployment rates in the year of DI application, and years of education of the benefit recipient. The base year is 1984, our first SIPP panel.

Table 3.1: Regression Analysis of Health Indicators for Male OASDI DI Recipients

	Dependent Variable																	
	Fair or Poor Health			# of Basic ADLs (Max. 2)			# of Instrumental ADLs (Max. 2)			# of Basic ADLs (Max. 6)			# of Instrumental ADLs (Max. 6)		
Dummy for Year 1990	-0.05	-0.04	-0.03	0.13 ***	0.13 ***	0.15 ***	-0.01	0.10	0.13						
	(.03)	(.04)	(.04)	(.04)	(.05)	(.05)	(.05)	(.06)	(.06)						
Dummy for Year 1991	-0.08 **	-0.08 *	-0.07	0.12 ***	0.14 ***	0.14 ***	-0.06	0.02	0.03	-0.04	-0.02	-0.05	-0.15	-0.15	-0.19
	(.04)	(.04)	(.04)	(.05)	(.05)	(.05)	(.06)	(.07)	(.07)	(.11)	(.12)	(.12)	(.12)	(.13)	(.13)
Dummy for Year 1993	-0.14 ***	-0.11 ***	-0.11 ***	0.11 ***	0.12 ***	0.12 ***	-0.08 *	-0.01	-0.01	-0.05	-0.07	-0.10	-0.04	-0.12	-0.15
	(.03)	(.04)	(.04)	(.04)	(.05)	(.05)	(.05)	(.06)	(.06)	(.09)	(.1)	(.1)	(.1)	(.11)	(.11)
Dummy for Year 1997	-0.14 ***	-0.13 ***	-0.12 ***	0.10 ***	0.12 ***	0.12 ***	-0.20 ***	-0.11 *	-0.10 *	-0.07	-0.07	-0.10	-0.27 ***	-0.28 ***	-0.31 ***
	(.03)	(.04)	(.04)	(.04)	(.04)	(.04)	(.04)	(.06)	(.06)	(.08)	(.09)	(.1)	(.09)	(.1)	(.1)
Dummy for Year 2002	-0.14 ***	-0.14 ***	-0.12 ***	0.03	0.04	0.04	-0.25 ***	-0.17 ***	-0.16 **	-0.21 **	-0.21 *	-0.24 **	-0.41 ***	-0.37 ***	-0.40 ***
	(.04)	(.04)	(.04)	(.04)	(.05)	(.05)	(.05)	(.07)	(.07)	(.1)	(.11)	(.11)	(.11)	(.12)	(.12)
Dummy for Year 2005	-0.14 ***	-0.13 ***	-0.11 ***	0.06 *	0.08 *	0.08 *	-0.26 ***	-0.16 ***	-0.15 ***	-0.15 *	-0.15	-0.18 *	-0.42 ***	-0.39 ***	-0.40 ***
	(.03)	(.04)	(.04)	(.04)	(.05)	(.05)	(.04)	(.06)	(.06)	(.08)	(.09)	(.1)	(.09)	(.1)	(.1)
State UE Rate in Yr of DI Application		0.00	0.00		0.01	0.01		0.01	0.01		0.01	0.01		0.06 *	0.06 *
		(.01)	(.01)		(.01)	(.01)		(.01)	(.01)		(.03)	(.03)		(.03)	(.03)
State UE Rate in Yr Prior to DI Application		0.00	0.00		-0.01	-0.01		0.00	0.00		-0.01	-0.02		-0.02	-0.03
		(.01)	(.01)		(.01)	(.01)		(.01)	(.01)		(.03)	(.03)		(.03)	(.03)
Years of Education			-0.01 ***			0.00			-0.01			0.00			-0.03 ***
			(.)			(.)			(.)			(.01)			(.01)
Constant	0.80 ***	0.79 ***	0.93 ***	0.18 ***	0.18 ***	0.20 ***	0.73 ***	0.59 ***	0.66 ***	0.71 ***	0.74 ***	0.79 ***	1.36 ***	1.15 ***	1.50 ***
	(.02)	(.05)	(.06)	(.03)	(.06)	(.07)	(.04)	(.07)	(.09)	(.07)	(.13)	(.16)	(.08)	(.14)	(.17)
Observations	3,442	2,986	2,984	3,946	3,424	3,412	3,946	3,424	3,412	3,538	3,185	3,173	3,538	3,185	3,173

Note: The excluded year in the regressions of Fair or Poor Health, # of Basic ADLs (Max. 2), and # of Instrumental ADLs (Max. 2) is 1984.
The excluded year in the regressions # of Basic ADLs (Max. 6), and # of Instrumental ADLs (Max. 6) is 1990, as four of each of the ADL measures are not available in SIPP panel 1984.
OASDI DI reciency is based on MBR administrative records. Health status is based on self-reported health measures in the SIPP.

Table 3.1 illustrates the results of the regression analysis for male OASDI disability recipients. In the regression of the indicator for fair or poor health, the year dummies are negative and highly significant, particularly starting in 1993. This indicates that relative to the base year 1984, a lower fraction of male OASDI disability recipients reports fair or poor health between 1993 and 2005. A male OASDI disability recipient interviewed about her health status is in the 1993 SIPP panel was 11% less likely to report fair or poor health relative to a recipient interviewed in the 1984 panel, controlling for state unemployment rate and years of education. The dummy for year 1991 is significant only in the specification where we do not control for state unemployment rates at the time of the disability application and years of education of the applicant. The size of the coefficients on the year dummies, however, remains relatively constant after 1993, suggesting that most of the improvement in health status took place between 1984 and 1993.

The variables for state unemployment rates in the application year, and the year prior to application, are not significant in most specifications, and change signs. We can thus not offer evidence that health status of disability applicants would vary with the business cycle. The year dummy coefficients for the regressions of the number of basic ADLs (maximum 2) are positive and significant. This is due to the fact that we observed a large increase in the average number of basic ADLs between our base year 1984 and the next panel 1990. When we consider the regressions of the number of basic ADLs (maximum 6), which we observe only starting in 1991, the year dummies, with a base year of 1990, are negative throughout, and significant for years 2002 and 2005. The regressions of the average number of instrumental ADLs also confirm that the average health status of disability recipients has improved over time, particularly since

1997. The coefficients are increasing in magnitude over time, suggesting that recipients have become continuously healthier on average between 1984 and 2002.

Comparing magnitudes, the coefficients on the years dummies when regression the number of basic ADLs (maximum 6) are around half the size of the equivalent coefficients in regressions of the number of instrumental ADLs (maximum 6). This suggests that while male OASDI disability recipients have gotten healthier over time along according to both measurements, it is the number of less severe impairments that has most decreased. One explanation could be that those with severe impairments among OASDI disability recipients did not change their health status dramatically, but those with less severe impairments have gotten significantly healthier over time. This would be consistent with a more lenient determination process over time.

Table 3.2: Regression Analysis of Health Indicators for Female OASDI DI Recipients

	Dependent Variable															
	Fair or Poor Health			# of Basic ADLs (Max. 2)			# of Instrumental ADLs (Max. 2)			# of Basic ADLs (Max. 6)			# of Instrumental ADLs (Max. 6)		
Dummy for Year 1990	-0.07	-0.02	-0.01	0.17 ***	0.18 **	0.19 ***	-0.04	-0.03	0.00						
	(.04)	(.05)	(.05)	(.05)	(.07)	(.07)	(.07)	(.09)	(.09)						
Dummy for Year 1991	-0.08 *	-0.03	-0.02	0.12 **	0.18 **	0.18 **	-0.21 ***	-0.18 **	-0.18 *	-0.15	-0.10	-0.12	-0.36 **	-0.25	-0.29 *
	(.05)	(.06)	(.06)	(.06)	(.07)	(.07)	(.08)	(.09)	(.09)	(.13)	(.15)	(.15)	(.15)	(.17)	(.17)
Dummy for Year 1993	-0.10 ***	-0.04	-0.03	0.18 ***	0.23 ***	0.23 ***	-0.13 **	-0.09	-0.08	-0.05	0.04	0.01	-0.08	0.05	0.01
	(.04)	(.05)	(.05)	(.05)	(.06)	(.06)	(.06)	(.08)	(.08)	(.11)	(.12)	(.12)	(.12)	(.13)	(.13)
Dummy for Year 1997	-0.11 ***	-0.08 *	-0.07	0.07	0.11 *	0.10 *	-0.26 ***	-0.24 ***	-0.24 ***	-0.29 ***	-0.25 **	-0.27 **	-0.50 ***	-0.43 ***	-0.47 ***
	(.04)	(.05)	(.05)	(.05)	(.06)	(.06)	(.06)	(.07)	(.08)	(.1)	(.11)	(.11)	(.14)	(.12)	(.12)
Dummy for Year 2002	-0.05	-0.02	-0.01	0.14 ***	0.18 ***	0.18 ***	-0.19 ***	-0.15 *	-0.14 *	-0.10	-0.01	-0.04	-0.28 **	-0.16	-0.19
	(.04)	(.05)	(.05)	(.05)	(.07)	(.07)	(.07)	(.08)	(.08)	(.11)	(.13)	(.13)	(.13)	(.14)	(.14)
Dummy for Year 2005	-0.06 *	-0.03	-0.02	0.08 *	0.11 *	0.11 *	-0.22 ***	-0.19 **	-0.18 **	-0.20 **	-0.14	-0.16	-0.40 ***	-0.30 **	-0.32 ***
	(.03)	(.05)	(.05)	(.04)	(.06)	(.06)	(.06)	(.08)	(.08)	(.1)	(.11)	(.11)	(.1)	(.12)	(.12)
State UE Rate in Yr of DI Application		-0.02	-0.02		-0.01	-0.01		-0.01	-0.01		-0.02	-0.02		-0.03	-0.03
		(.01)	(.01)		(.01)	(.01)		(.01)	(.02)		(.03)	(.03)		(.04)	(.04)
State UE Rate in Yr Prior to DI Application		0.01	0.01		0.01	0.01		0.01	0.02		0.03	0.03		0.03	0.03
		(.01)	(.01)		(.01)	(.01)		(.01)	(.02)		(.03)	(.03)		(.04)	(.04)
Years of Education			-0.01 *			0.00			-0.01			0.00			-0.03 **
			(.)			(.)			(.01)			(.01)			(.01)
Constant	0.76 ***	0.74 ***	0.81 ***	0.20 ***	0.16 **	0.14	0.93 ***	0.85 ***	0.93 ***	0.87 ***	0.75 ***	0.80 ***	1.66 ***	1.52 ***	1.88 ***
	(.03)	(.06)	(.07)	(.04)	(.08)	-(.09)	(.05)	(.1)	(.11)	(.08)	(.15)	(.19)	(.09)	(.16)	(.2)
Observations	2,887	2,534	2,534	3,254	2,882	2,875	3,254	2,882	2,875	2,994	2,740	2,733	2,994	2,740	2,733

Note: The excluded year in the regressions of Fair or Poor Health, # of Basic ADLs (Max. 2), and # of Instrumental ADLs (Max. 2) is 1984.
The excluded year in the regressions # of Basic ADLs (Max. 6), and # of Instrumental ADLs (Max. 6) is 1990, as four of each of the ADL measures are not available in SIPP panel 1984.
OASDI DI reciency is based on MBR administrative records. Health status is based on self-reported health measures in the SIPP.

Table 3.2 conducts the same exercise for female OASDI disability recipients. Here we also observe an improvement of OSADI disability recipients' health status, particularly when measuring health status with the average number of instrumental ADLs. Starting in 1991, year dummies are negative and significant in all specifications. A female OASDI disability recipient interviewed in 1997 reported on average 0.47 fewer out of 6 possible instrumental ADLs compared to someone interviewed in 1984. In the regressions of the average number of basic ADLs (maximum 2), we encounter the same issue as for male OASDI disability recipients: due to the steep increase in the number of basic ADLs between 1984 and 1990, coefficients on the year dummies have a positive sign. When considering 6 possible basic ADLs as a measure of health status though, with a base year of 1990, the coefficients on all year dummies are negative, and significant for the year 1997. Comparable to the results for male recipients, we find that the improvement in health status is much more pronounced along the dimension of less severe impairments. Those with more severe ("basic") impairments in the population of female OASDI disability recipients likely experienced less of an improvement. State unemployment rates at disability application continue to be insignificant.

Table 3.3 shows regressions of our various health indicators for male SSI recipients. As we had already observed in the graphical representations, the trend in the health status of SSI recipients is less clear. While the coefficients on the year dummies are negative throughout (apart from the regressions of the number of basic ADLs), they are mostly insignificant. When regressing the number of instrumental ADLs (maximum 6) with a base year of 1990, the coefficients on the year dummies are significant starting in 1993. However, when controlling for state unemployment rates and years of education, the coefficients lose significance.

Table 3.3: Regression Analysis of Health Indicators for Male SSI DI Recipients

	Dependent Variable															
	Fair or Poor Health			# of Basic ADLs (Max. 2)			# of Instrumental ADLs (Max. 2)			# of Basic ADLs (Max. 6)			# of Instrumental ADLs (Max. 6)		
Dummy for Year 1990	-0.10	-0.15 *	-0.13	0.03	-0.12	-0.10	0.05	0.01	0.06						
	(.06)	(.08)	(.08)	(.07)	(.09)	(.09)	(.09)	(.12)	(.12)						
Dummy for Year 1991	-0.07	-0.13	-0.10	0.01	-0.03	-0.03	-0.01	0.05	0.06	0.02	0.25	0.22	-0.31	-0.15	-0.24
	(.07)	(.09)	(.09)	(.07)	(.09)	(.09)	(.1)	(.12)	(.12)	(.17)	(.2)	(.21)	(.21)	(.24)	(.25)
Dummy for Year 1993	-0.14 **	-0.16 **	-0.14 *	0.01	-0.04	-0.04	-0.07	-0.04	-0.03	-0.12	0.11	0.08	-0.28 *	-0.21	-0.29
	(.06)	(.08)	(.08)	(.06)	(.08)	(.08)	(.08)	(.1)	(.11)	(.14)	(.16)	(.17)	(.17)	(.19)	(.2)
Dummy for Year 1997	-0.06	-0.11	-0.09	0.04	-0.02	-0.02	-0.02	-0.02	-0.01	0.01	0.21	0.18	-0.36 **	-0.20	-0.29
	(.05)	(.07)	(.07)	(.06)	(.07)	(.08)	(.08)	(.1)	(.1)	(.12)	(.15)	(.15)	(.15)	(.18)	(.18)
Dummy for Year 2002	-0.09	-0.15 *	-0.11	0.02	-0.08	-0.08	-0.04	-0.05	-0.04	-0.02	0.11	0.08	-0.43 **	-0.32	-0.40 **
	(.06)	(.08)	(.08)	(.06)	(.08)	(.08)	(.09)	(.11)	(.11)	(.14)	(.16)	(.17)	(.18)	(.2)	(.2)
Dummy for Year 2005	-0.08	-0.14 *	-0.10	0.05	-0.02	-0.01	-0.02	0.00	0.02	0.00	0.25 *	0.22	-0.40 **	-0.17	-0.23
	(.06)	(.07)	(.07)	(.06)	(.08)	(.08)	(.08)	(.1)	(.1)	(.13)	(.15)	(.16)	(.16)	(.18)	(.19)
State UE Rate in Yr of SSI Application		0.00	-0.01		0.00	0.00		0.01	0.01		0.01	0.01		0.04	0.04
		(.01)	(.01)		(.01)	(.01)		(.02)	(.02)		(.04)	(.04)		(.04)	(.04)
State UE Rate in Yr Prior to SSI Application		0.00	0.00		0.00	0.00		-0.01	-0.01		0.01	0.01		-0.02	-0.02
		(.01)	(.01)		(.01)	(.01)		(.02)	(.02)		(.04)	(.04)		(.04)	(.04)
Years of Education			-0.02 ***			0.00			-0.01			-0.01			-0.04 **
			(.)			(.01)			(.01)			(.01)			(.02)
Constant	0.66 ***	0.72 ***	0.86 ***	0.16 ***	0.22 **	0.23 **	0.52 ***	0.45 ***	0.50 ***	0.54 ***	0.22	0.32	1.53 ***	1.13 ***	1.59 ***
	(.05)	(.09)	(.1)	(.05)	(.09)	(.1)	(.07)	(.12)	(.13)	(.11)	(.19)	(.23)	(.13)	(.22)	(.27)
Observations	1,490	1,200	1,198	1,734	1,408	1,398	1,734	1,408	1,398	1,624	1,349	1,339	1,624	1,349	1,339

Note: The excluded year in the regressions of Fair or Poor Health, # of Basic ADLs (Max. 2), and # of Instrumental ADLs (Max. 2) is 1984.
The excluded year in the regressions # of Basic ADLs (Max. 6), and # of Instrumental ADLs (Max. 6) is 1990, as four of each of the ADL measures are not available in SIPP panel 1984.
SSI DI recipiency is based on SSR administrative records. Health status is based on self-reported health measures in the SIPP.

Table 3.4: Regression Analysis of Health Indicators for Female SSI DI Recipients

	Dependent Variable															
	Fair or Poor Health			# of Basic ADLs (Max. 2)			# of Instrumental ADLs (Max. 2)			# of Basic ADLs (Max. 6)			# of Instrumental ADLs (Max. 6)		
Dummy for Year 1990	0.00	-0.01	0.00	0.10 *	0.16 **	0.17 **	-0.03	-0.05	-0.01						
	(.05)	(.06)	(.06)	(.06)	(.08)	(.08)	(.07)	(.1)	(.1)						
Dummy for Year 1991	-0.04	-0.04	-0.02	0.04	0.03	0.03	-0.08	-0.15	-0.14	-0.09	-0.24	-0.27	-0.19	-0.31	-0.35 *
	(.05)	(.07)	(.07)	(.06)	(.08)	(.08)	(.08)	(.11)	(.11)	(.14)	(.17)	(.17)	(.16)	(.19)	(.19)
Dummy for Year 1993	0.01	0.05	0.06	0.07	0.17 **	0.16 **	-0.03	0.02	0.03	-0.08	-0.04	-0.07	-0.06	-0.02	-0.07
	(.04)	(.06)	(.06)	(.05)	(.07)	(.07)	(.07)	(.09)	(.09)	(.11)	(.13)	(.14)	(.13)	(.15)	(.16)
Dummy for Year 1997	-0.02	-0.01	0.00	0.05	0.12 *	0.12 *	-0.15 **	-0.14 *	-0.13	-0.17	-0.18	-0.22	-0.41 ***	-0.35 **	-0.41 ***
	(.04)	(.05)	(.06)	(.05)	(.06)	(.07)	(.06)	(.09)	(.09)	(.11)	(.12)	(.13)	(.12)	(.14)	(.14)
Dummy for Year 2002	0.00	0.01	0.02	0.02	0.08	0.08	-0.20 ***	-0.19 **	-0.18 *	-0.18	-0.19	-0.23	-0.49 ***	-0.43 ***	-0.47 ***
	(.04)	(.06)	(.06)	(.05)	(.07)	(.07)	(.07)	(.09)	(.09)	(.12)	(.14)	(.14)	(.14)	(.16)	(.16)
Dummy for Year 2005	-0.03	-0.02	-0.01	0.01	0.08	0.08	-0.15 **	-0.13	-0.12	-0.17	-0.17	-0.21	-0.33 ***	-0.24 *	-0.26 *
	(.04)	(.05)	(.06)	(.05)	(.07)	(.07)	(.06)	(.09)	(.09)	(.11)	(.12)	(.13)	(.12)	(.14)	(.15)
State UE Rate in Yr of SSI Application		-0.01	-0.02		-0.02	-0.02		0.00	0.00		-0.03	-0.03		0.01	0.00
		(.01)	(.01)		(.01)	(.01)		(.02)	-(.02)		(.03)	(.03)		(.03)	(.03)
State UE Rate in Yr Prior to SSI Application		0.02	0.02		0.02 **	0.02 **		0.00	0.01		0.04	0.04		0.01	0.02
		(.01)	(.01)		(.01)	(.01)		(.02)	(.02)		(.03)	(.03)		(.03)	(.03)
Years of Education			-0.01			0.00			-0.01			0.00			-0.04 ***
			(.)			(.)			(.01)			(.01)			(.01)
Constant	0.68 ***	0.67 ***	0.71 ***	0.21 ***	0.09	0.08	0.78 ***	0.76 ***	0.82 ***	0.73 ***	0.63 ***	0.67	1.54 ***	1.35 ***	1.80 ***
	(.03)	(.07)	(.08)	(.04)	(.08)	(.09)	(.05)	(.11)	(.12)	(.09)	(.16)	(.19)	(.11)	(.19)	(.22)
Observations	2,309	1,854	1,853	2,597	2,100	2,093	2,597	2,100	2,093	2,382	2,003	1,996	2,382	2,003	1,996

Note: The excluded year in the regressions of Fair or Poor Health, # of Basic ADLs (Max. 2), and # of Instrumental ADLs (Max. 2) is 1984.
The excluded year in the regressions # of Basic ADLs (Max. 6), and # of Instrumental ADLs (Max. 6) is 1990, as four of each of the ADL measures are not available in SIPP panel 1984.
SSI DI recipiency is based on SSR administrative records. Health status is based on self-reported health measures in the SIPP.

Table 3.4 illustrates regressions for female SSI recipients. When using fair or poor health or basic ADLs as an indicator for health status, coefficients on the year dummies are mostly insignificant. However, when we measure health status by the average number of instrumental ADLs, coefficients are negative and significant starting in year 1997.

Given that we found that improvements in the health status of disability benefit recipients mainly occurred on the dimension of less severe impairments, it is interesting to consider trends in health status by diagnosis codes. Table 3.5 illustrates changes in the composition of the recipient population in terms of primary diagnoses, and breaks out average health status for each of our measures by diagnoses. We use major primary diagnosis code groups, as defined by the Office of the Deputy Commissioner, Disability and Income Security Programs: circulatory, endocrine and nutrition, mental disorders, musculoskeletal, nervous and sense, and other categories.

Table 3.5 shows that there has been a pronounced increase in the fraction of OASDI DI recipients with a primary diagnosis of mental disorders, from 17% in 1984 to 33% in 2005. Most of the increase took place between 1984 and 1991. This is consistent with the implementation of new mental disorder diagnoses in 1986. Between the 1984 and 1990 panels, we also observe a steep increase in the fraction of OASDI disability recipients with a musculoskeletal impairment from 9% to 19%. Since the 1993 panel, the fraction of OASDI disability recipients with circulatory impairments has decreased from 16% to 11% in the 2005 panel. We thus do not observe a simultaneous decrease in circulatory diagnoses with the large increase in musculoskeletal diagnoses. Rather, the main increase in musculoskeletal cases occurred before.

Table 3.5: Health and ADL Status for DI and SSI Recipients Over Time

Men on OASDI DI

	% of Observations							% Fair or Poor Health							# Basic ADL Limitations (Max. 2)							# Instrumental ADL Limitations (Max. 2)							# Basic ADL Limitations (Max. 6)							# Instrumental ADL Limitations (Max. 6)						
	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005
Primary Diagnosis																																										
Circulatory	11%	17%	13%	16%	14%	13%	11%	88%	81%	73%	80%	78%	74%	72%	0.23	0.23	0.19	0.17	0.27	0.16	0.15	0.77	0.57	0.76	0.74	0.56	0.47	0.57	0.64	0.49	0.39	0.55	0.42	0.30	1.01	1.24	1.24	1.02	0.86	0.97
Endocr + Nutrit	3%	4%	5%	4%	4%	5%	4%	85%	87%	75%	83%	57%	69%	84%	0.15	0.33	0.43	0.29	0.36	0.13	0.35	0.85	0.73	0.50	0.81	0.55	0.63	0.55	0.87	0.86	0.67	0.88	0.25	0.83	1.20	1.21	1.24	1.15	0.75	1.03
Mental Disorders	17%	21%	26%	28%	32%	27%	33%	56%	60%	46%	52%	55%	53%	55%	0.13	0.14	0.18	0.14	0.14	0.10	0.11	0.46	0.51	0.41	0.41	0.35	0.26	0.31	0.28	0.43	0.36	0.35	0.33	0.25	1.19	0.88	1.22	0.92	0.78	0.72
Musculoskeletal	9%	19%	20%	17%	17%	22%	22%	91%	81%	86%	74%	82%	74%	76%	0.32	0.40	0.34	0.52	0.49	0.32	0.34	0.92	0.83	0.85	0.87	0.65	0.58	0.56	0.78	0.68	1.11	1.04	0.62	0.73	1.30	1.36	1.52	1.06	0.97	0.91
Nervous + Sense	5%	9%	8%	7%	8%	10%	9%	53%	69%	52%	52%	55%	60%	61%	0.37	0.40	0.38	0.41	0.35	0.34	0.45	0.63	0.97	0.67	0.64	0.62	0.74	0.67	0.91	0.83	0.89	0.73	0.83	1.11	2.06	1.29	1.32	1.39	1.60	1.57
Other	55%	30%	29%	28%	25%	24%	21%	86%	77%	90%	66%	68%	71%	65%	0.14	0.37	0.36	0.30	0.26	0.20	0.27	0.78	0.82	0.77	0.68	0.65	0.50	0.51	0.94	0.90	0.80	0.72	0.56	0.73	1.55	1.38	1.35	1.26	0.95	1.05
Total	100%	100%	100%	100%	100%	100%	100%	80%	75%	72%	65%	66%	66%	65%	0.18	0.30	0.29	0.28	0.28	0.20	0.24	0.73	0.72	0.67	0.65	0.53	0.48	0.48	0.71	0.68	0.67	0.64	0.51	0.56	1.36	1.21	1.32	1.09	0.96	0.95

Men on SSI DI

	% of Observations							% Fair or Poor Health							# Basic ADL Limitations (Max. 2)							# Instrumental ADL Limitations (Max. 2)							# Basic ADL Limitations (Max. 6)							# Instrumental ADL Limitations (Max. 6)						
	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005
Primary Diagnosis																																										
Circulatory	0%	7%	10%	6%	5%	6%	5%		80%	78%	87%	84%	83%	80%		0.27	0.30	0.13	0.23	0.25	0.10		0.64	0.50	0.75	0.42	0.92	0.45		0.55	0.90	0.13	0.62	0.50	0.30		1.18	1.20	1.00	1.00	1.33	0.90
Endocr + Nutrit	0%	0%	0%	0%	4%	0%	3%					92%		67%					0.56		-					0.89		0.64					1.11		0.27					1.67		1.18
Mental Disorders	35%	44%	48%	52%	53%	55%	56%	51%	45%	47%	42%	51%	46%	52%	0.11	-	0.08	0.07	0.13	0.07	0.11	0.24	0.32	0.34	0.30	0.36	0.26	0.38	0.13	0.28	0.18	0.32	0.23	0.27	1.44	0.96	1.14	0.93	0.77	0.97
Musculoskeletal	0%	0%	0%	0%	7%	9%	10%					76%	88%	81%					0.26	0.25	0.42					0.68	0.55	0.78					0.56	0.60	0.86					1.00	1.00	1.14
Nervous + Sense	0%	10%	0%	9%	7%	7%	6%		50%		46%	56%	50%	68%		0.35		0.42	0.44	0.33	0.35		0.76		0.73	0.71	0.80	0.61		0.88		1.19	1.24	1.20	1.00		1.71		2.08	1.74	1.60	1.83
Other	50%	35%	35%	29%	24%	23%	20%	69%	67%	72%	59%	67%	65%	55%	0.16	0.37	0.31	0.24	0.25	0.33	0.43	0.65	0.75	0.78	0.48	0.65	0.73	0.65	0.93	0.97	0.53	0.75	0.94	1.14	1.65	1.67	1.13	1.54	1.71	1.45
Total	100%	100%	100%	100%	100%	100%	100%	66%	56%	59%	52%	60%	57%	58%	0.16	0.20	0.17	0.17	0.21	0.18	0.21	0.52	0.57	0.51	0.45	0.50	0.47	0.50	0.54	0.56	0.42	0.55	0.52	0.54	1.53	1.22	1.25	1.17	1.10	1.13

Women on OASDI DI

	% of Observations							% Fair or Poor Health							# Basic ADL Limitations (Max. 2)							# Instrumental ADL Limitations (Max. 2)							# Basic ADL Limitations (Max. 6)							# Instrumental ADL Limitations (Max. 6)						
	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005
Primary Diagnosis																																										
Circulatory	8%	11%	11%	11%	8%	6%	6%	75%	79%	83%	81%	78%	67%	83%	-	0.29	0.20	0.38	0.36	0.29	0.28	0.95	1.06	0.65	0.88	0.89	0.71	0.82	0.82	0.45	0.96	0.75	0.48	0.67	1.71	0.95	1.83	1.48	1.19	1.45
Endocr + Nutrit	0%	4%	8%	6%	8%	8%	7%		75%	93%	87%	86%	73%	87%		0.38	0.87	0.58	0.41	0.67	0.31		1.15	1.00	0.92	0.83	1.04	0.96		0.92	1.27	1.04	0.90	1.44	0.73		1.77	1.73	1.88	1.41	1.89	1.54
Mental Disorders	17%	23%	25%	31%	31%	36%	33%	54%	67%	43%	59%	52%	62%	62%	-	0.23	0.15	0.15	0.13	0.18	0.24	0.40	0.74	0.40	0.46	0.43	0.46	0.54	0.67	0.40	0.26	0.29	0.37	0.54	1.70	1.02	1.09	0.83	0.95	1.06
Musculoskeletal	11%	22%	13%	20%	19%	21%	27%	75%	77%	79%	79%	78%	81%	74%	0.24	0.44	0.28	0.59	0.40	0.42	0.31	1.10	0.91	0.76	1.14	0.89	1.08	0.78	0.94	0.68	1.21	0.84	0.93	0.69	1.48	1.16	1.91	1.42	1.72	1.24
Nervous + Sense	6%	10%	11%	9%	11%	9%	11%	54%	61%	50%	63%	54%	63%	57%	0.31	0.32	0.24	0.64	0.31	0.47	0.31	1.06	0.87	0.81	0.95	0.62	0.93	0.82	0.87	0.81	1.69	0.71	1.30	0.93	1.68	1.52	1.92	1.25	2.00	1.58
Other	57%	29%	32%	24%	22%	21%	16%	85%	66%	77%	55%	67%	84%	78%	0.25	0.46	0.41	0.36	0.26	0.37	0.28	1.01	0.88	0.87	0.80	0.68	0.68	0.69	1.00	0.92	0.79	0.50	0.92	0.70	1.71	1.49	1.60	1.14	1.34	1.23
Total	100%	100%	100%	100%	100%	100%	100%	76%	70%	69%	67%	66%	72%	70%	0.20	0.36	0.32	0.38	0.27	0.34	0.28	0.93	0.89	0.72	0.79	0.67	0.74	0.70	0.87	0.72	0.82	0.58	0.77	0.67	1.66	1.29	1.58	1.16	1.37	1.25

Women on SSI DI

	% of Observations							% Fair or Poor Health							# Basic ADL Limitations (Max. 2)							# Instrumental ADL Limitations (Max. 2)							# Basic ADL Limitations (Max. 6)							# Instrumental ADL Limitations (Max. 6)						
	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005	1984	1990	1991	1993	1997	2002	2005
Primary Diagnosis																																										
Circulatory	5%	7%	0%	6%	7%	3%	4%	90%	87%		94%	87%	67%	78%	0.30	0.67		0.36	0.39	0.45	0.36	1.20	1.13		1.05	0.91	0.82	0.96		1.47		0.73	0.95	0.82	0.84		2.20		1.73	1.59	1.55	1.88
Endocr + Nutrit	0%	9%	8%	9%	8%	7%	6%		89%	83%	69%	91%	83%	88%		0.26	0.25	0.42	0.57	0.36	0.36		0.95	0.58	0.72	0.91	0.73	0.95		0.58	0.42	0.92	1.25	0.91	0.95		1.63	0.75	1.61	1.55	1.55	1.57
Mental Disorders	25%	40%	42%	40%	49%	52%	52%	55%	60%	43%	60%	59%	60%	59%	0.06	0.18	0.12	0.15	0.17	0.15	0.17	0.31	0.54	0.42	0.57	0.48	0.46	0.51	0.54	0.36	0.32	0.39	0.38	0.41	1.39	1.02	1.24	0.91	0.87	1.05
Musculoskeletal	8%	7%	0%	11%	9%	11%	15%	65%	93%		93%	80%	84%	74%	0.24	0.87		0.60	0.45	0.15	0.21	0.94	1.20		1.19	0.93	0.65	0.73		1.80		1.30	0.93	0.29	0.45		2.07		1.88	1.55	0.82	1.08
Nervous + Sense	5%	7%	6%	9%	7%	7%	7%	44%	73%	56%	52%	43%	68%	58%	0.10	0.53	0.10	0.34	0.19	0.52	0.38	0.90	0.93	0.70	0.77	0.44	0.81	0.78	1.33	0.40	1.06	0.47	1.33	1.20	2.00	1.50	1.80	1.05	1.62	1.87
Other	56%	30%	33%	25%	21%	20%	15%	75%	62%	80%	73%	67%	76%	72%	0.28	0.24	0.44	0.26	0.24	0.30	0.26	0.90	0.73	1.04	0.78	0.71	0.68	0.66	0.47	1.21	0.62	0.45	0.71	0.65	1.35	2.02	1.48	1.18	1.21	1.27
Total	100%	100%	100%	100%	100%	100%	100%	68%	68%	64%	69%	66%	69%	66%	0.21	0.31	0.25	0.28	0.26	0.23	0.22	0.78	0.75	0.69	0.75	0.63	0.58	0.63	0.73	0.64	0.65	0.56	0.55	0.56	1.54	1.35	1.48	1.13	1.05	1.21

It is interesting to note that SSI recipients are much more likely to have mental disorders as a primary diagnosis than OASDI disability recipients (in the 2005 panel, 56% of SSI recipients had a mental disorder diagnosis, compared to 33% of OASDI disability recipients).

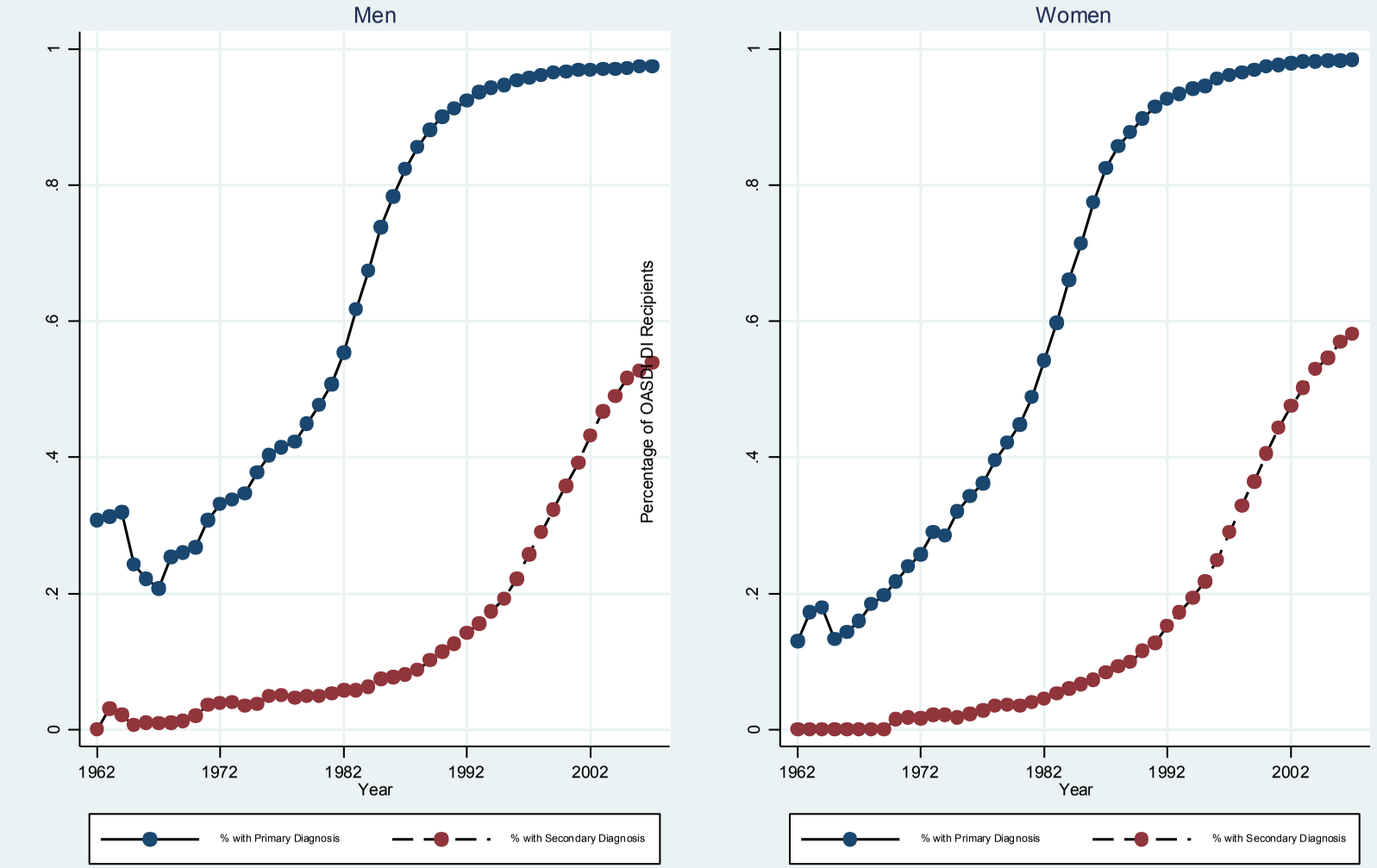
The distribution of primary diagnoses for female OASDI disability recipients is similar to male recipients, with similar increasing trends in mental disorder and musculoskeletal diagnoses. The main difference is that a lower fraction of female recipients has a circulatory diagnosis, and a higher fraction has an endocrine/nutrition or musculoskeletal diagnoses. Female SSI recipients are also significantly more likely to have a mental disorder diagnosis relative to female OASDI disability recipients (52% vs 33% in the 2005 panel).

Among male OASDI disability recipients, the health status has improved for those with a circulatory or musculoskeletal diagnosis. Of those with circulatory (musculoskeletal) diagnoses, 88% (91%) interviewed in 1984 reported fair or poor health, compared to 72% (76%) of those interviewed in 2005. Moreover, those with a mental disorder diagnosis have a significantly better health status on average, given that most health status measures involve physical limitations. Even when considering self-reported health, between 52%-60% of those with a mental disorder diagnosis report fair or poor health, compared with approximately 70-90% for most other diagnosis categories. The overall improvement in average health status of disability recipients is thus the effect of both composition and a decreasing trend: An increasing fraction of recipients have mental disorder diagnoses, and have a higher reported health status, while in a key and growing diagnosis category, musculoskeletal diseases, individuals have become healthier in the cross-section, suggested a more lenient determination process over time.

In contrast, among female OASDI DI recipients, we do not observe a clear improving trend in terms of health status in any specific diagnosis category.

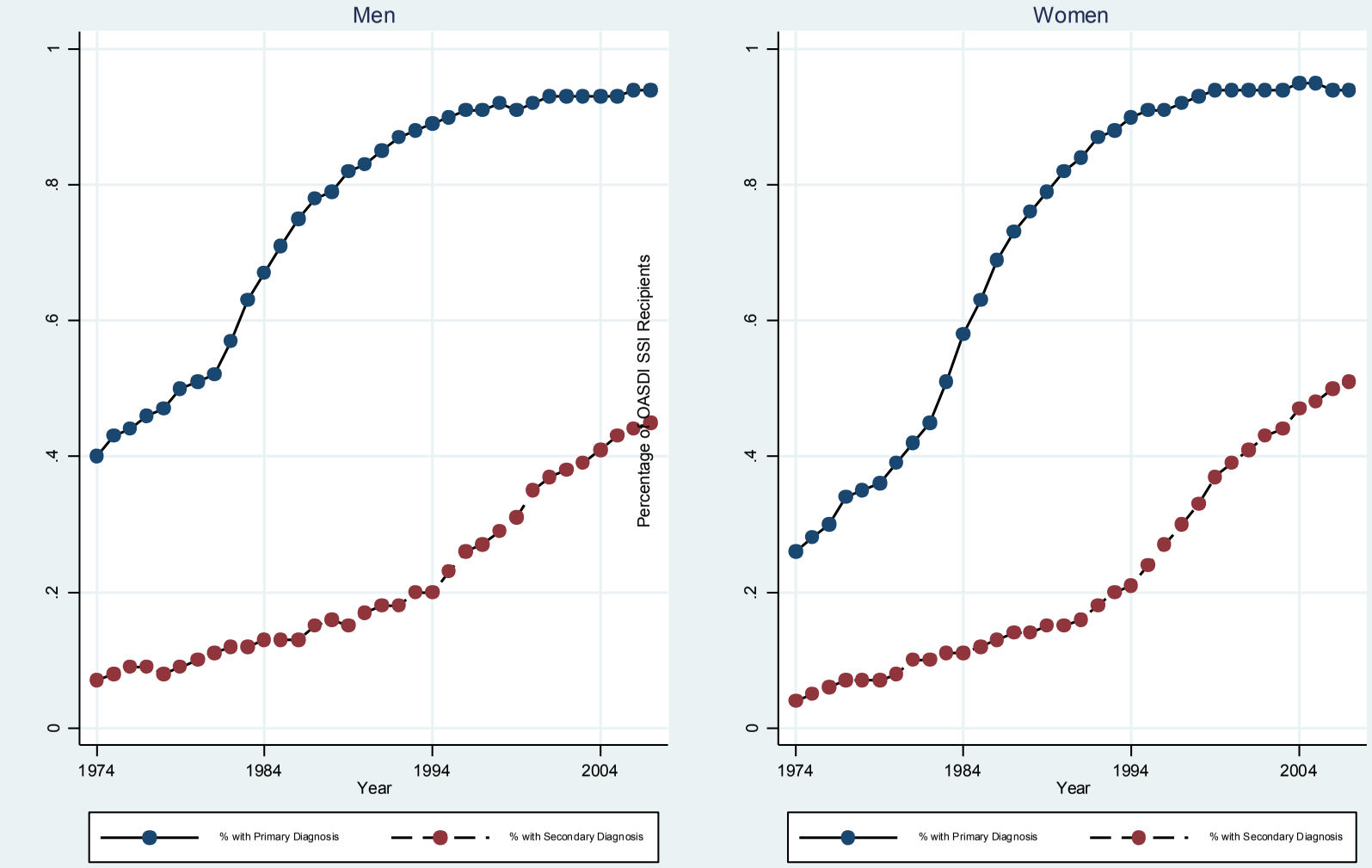
Figures 3.6 and 3.7 highlight an issue with the MBR and SSR data on diagnosis codes. We show the percentage of male OASDI disability (Figure 3.6) and SSI (Figure 3.7) recipients with primary and secondary diagnosis codes. From 1995 to 2007, the fraction of male OASDI disability (SSI) recipients with an associated secondary diagnosis code has increased dramatically from 19% (23%) in 1995 to 54% (45%) in 2007. The equivalent percentage with a primary diagnosis increased from 95% (90%) to 97% (94%) over the same time period. The fraction with primary diagnosis codes went through a sharp increase earlier (between the late 1960s and early 1990s). A similar trend can be observed for female OASDI disability and SSI recipients. In the absence of an explanation on why diagnosis codes were recorded more diligently over time, this puts the reliability and representativeness of early MBR and SSR data in question. It might be that only individuals with severe impairments had a diagnosis code recorded, skewing the resulting composition of diagnosis codes. The increase in the fraction with multiple impairments, and thus a secondary diagnosis code, over time is also notable. This might be the result of a change in rules as part of the 1984 Social Security Disability Benefits Reform Act. Prior to the amendment, a case could not proceed unless the individual had at least one severe impairment. After 1984, the disability determination process considers the combined effect of all of a person's impairments, which means that multiple non-severe impairments can now constitute a disability (Collins and Erfle 1985).

Figure 3.6: Percentage of OASDI DI Recipients with Primary and Secondary Diagnoses



Note: Primary and secondary diagnosis codes from administrative MBR file.

Figure 3.7: Percentage of SSI DI Recipients with Primary and Secondary Diagnoses



Note: Primary and secondary diagnosis codes from administrative MBR file.

3.4 Conclusion

The results in this paper are preliminary. They provide evidence that the average disability benefits recipient in the 1990s was healthier than the average recipient in the mid 1980s. We measure health status based on self-reported measures of overall health, as well as limitations in basic and instrumental Activities of Daily Living (ADLs). The improvement in average health status is starkest for male OASDI disability recipients. This improvement is driven by two forces. First, we observe an increasing fraction of recipients with mental disorder diagnoses over time. Given that individuals with mental disorder diagnoses self-report to be healthier, on average, than those with other diagnoses, the average health status of all DI and SSI recipients improved over time. Second, we show that there has been an improvement in health status for those with musculoskeletal impairments, a growing diagnosis category. For this diagnosis group in particular, health status improvement is strongest when we measure non-severe impairments (instrumental ADLs). This suggests that the improvement in average health status of DI and SSI recipients is mainly due to those with less-severe impairments reporting significantly fewer limitations in more recent years. The health status of those with severe impairments has remained relatively more stable.

Further analysis is needed in order to determine the extent to which this trend can be explained by changes in the age distribution of the eligible population, increased program leniency, and health care trends that improve the well-being of individuals with impairments.

Appendix

Appendix Table 1: Annual Earnings with Full-Time Job at Minimum Wage by Year

Year	Hourly Minimum Wage	Hourly Minimum Wage (2007 USD)	Implied Annual Earnings FT Job	70% of Annual Earnings FT Job
1951	$0.75	$5.98	$12,441	$8,708
1952	$0.75	$5.87	$12,206	$8,544
1953	$0.75	$5.82	$12,114	$8,480
1954	$0.75	$5.78	$12,024	$8,417
1955	$0.75	$5.80	$12,069	$8,448
1956	$1.00	$7.62	$15,856	$11,099
1957	$1.00	$7.38	$15,348	$10,743
1958	$1.00	$7.17	$14,923	$10,446
1959	$1.00	$7.13	$14,820	$10,374
1960	$1.00	$7.00	$14,570	$10,199
1961	$1.15	$7.97	$16,587	$11,611
1962	$1.15	$7.90	$16,423	$11,496
1963	$1.25	$8.47	$17,617	$12,332
1964	$1.25	$8.36	$17,390	$12,173
1965	$1.25	$8.23	$17,114	$11,980
1966	$1.25	$8.00	$16,639	$11,647
1967	$1.40	$8.69	$18,077	$12,654
1968	$1.60	$9.53	$19,829	$13,880
1969	$1.60	$9.04	$18,802	$13,161
1970	$1.60	$8.55	$17,784	$12,449
1971	$1.60	$8.19	$17,038	$11,927
1972	$1.60	$7.94	$16,508	$11,556
1973	$1.60	$7.47	$15,541	$10,879
1974	$2.00	$8.41	$17,496	$12,247
1975	$2.10	$8.09	$16,834	$11,784
1976	$2.30	$8.38	$17,433	$12,203
1977	$2.30	$7.87	$16,368	$11,458
1978	$2.65	$8.43	$17,529	$12,270
1979	$2.90	$8.28	$17,227	$12,059
1980	$3.10	$7.80	$16,225	$11,358
1981	$3.35	$7.64	$15,894	$11,126
1982	$3.35	$7.20	$14,972	$10,480
1983	$3.35	$6.97	$14,506	$10,154
1984	$3.35	$6.69	$13,905	$9,734
1985	$3.35	$6.46	$13,427	$9,399
1986	$3.35	$6.34	$13,182	$9,227
1987	$3.35	$6.11	$12,718	$8,903
1988	$3.35	$5.87	$12,213	$8,549
1989	$3.35	$5.60	$11,651	$8,156
1990	$3.80	$6.03	$12,539	$8,777
1991	$4.25	$6.47	$13,457	$9,420
1992	$4.25	$6.28	$13,064	$9,145
1993	$4.25	$6.10	$12,684	$8,879
1994	$4.25	$5.95	$12,368	$8,657
1995	$4.25	$5.78	$12,027	$8,419
1996	$4.75	$6.28	$13,056	$9,139
1997	$5.15	$6.65	$13,838	$9,687
1998	$5.15	$6.55	$13,626	$9,538
1999	$5.15	$6.41	$13,332	$9,332
2000	$5.15	$6.20	$12,898	$9,029
2001	$5.15	$6.03	$12,541	$8,779
2002	$5.15	$5.94	$12,346	$8,642
2003	$5.15	$5.80	$12,071	$8,450
2004	$5.15	$5.65	$11,758	$8,230
2005	$5.15	$5.47	$11,372	$7,961
2006	$5.15	$5.30	$11,017	$7,712
2007	$5.85	$5.85	$12,168	$8,518

Source: U.S. Department of Labor.
Annual earnings of full-time job assumes 40 hours work per week, for 52 weeks.

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